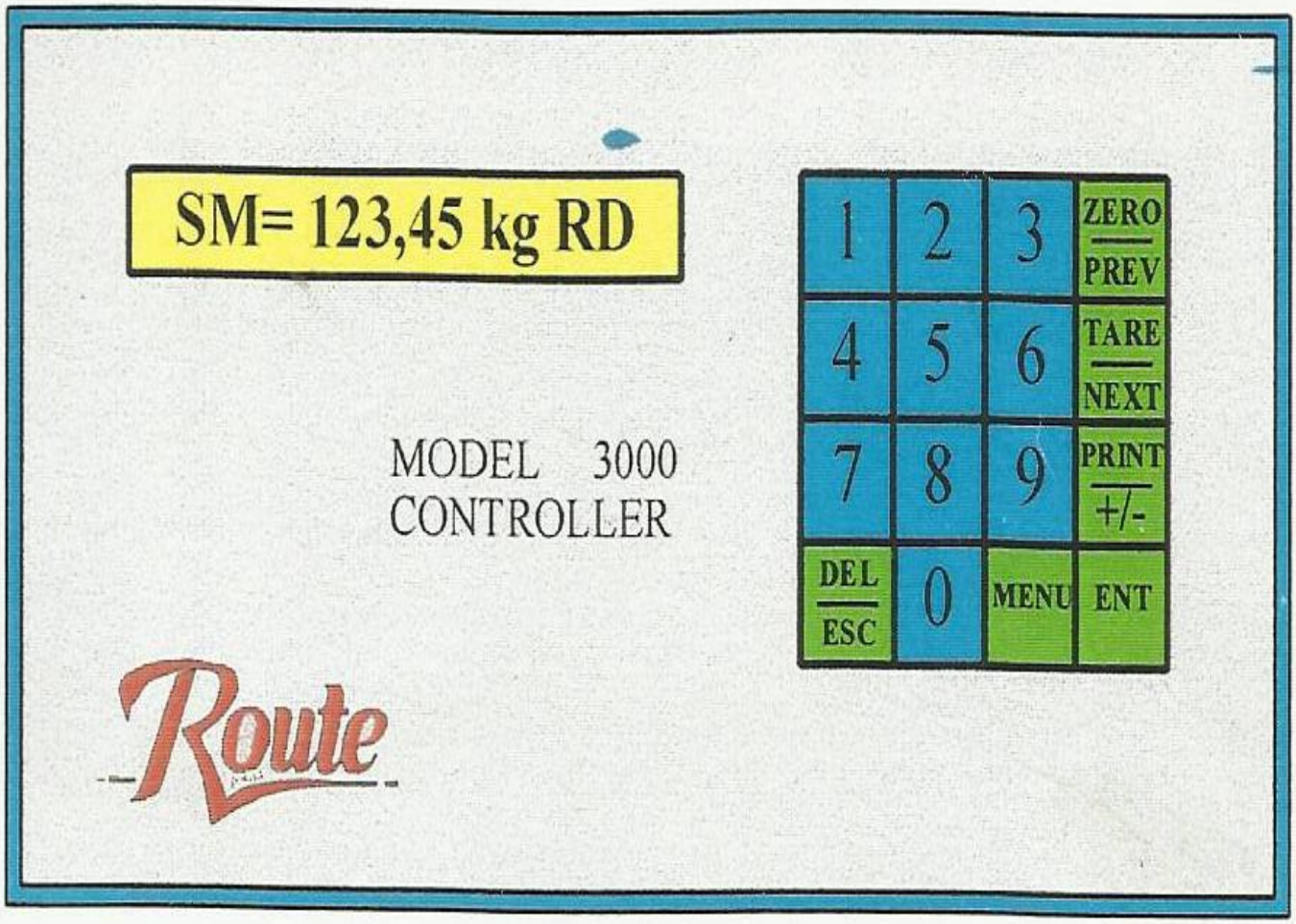
Route Controller



Front Panel Operation

Route Controller

Front Panel Operation

Please note:

In correspondence concerning your instrument, please quote the type number and serial number as given on the type plate.

If available, also note the software release and revision number printed on the EPROM's label

Important:

As this instrument is an electrical apparatus, it may be operated only by trained personnel. Maintenance and repairs may also be carried out only by qualified personnel as appointed by Loadcell Systems (Pty) Ltd.

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Preface

This section contains a discussion of the front panel of the ***Route*** controller. A detailed explanation of the functions and uses of the components that forms part of the front panel (*such as the Keyboard, Display, Function Key-switch, Function LED Indicators and the Name Plate*) are included.

This section is however not intended to be a complete reference to the functions included within this manual. Each of the functions provided are discussed in full detail in the relevant sections as indicated.

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1 Introduction

The front panel of the ***Route*** controller is the operators means of communicating with the controller. By means of the front panel, the operator/engineer may issue instructions to the controller, or request information from the controller.

An ongoing Research and Development Program, which involves both the hardware and software of the ***Route*** series controllers, ensures a continues improvement and expansion of the functions and facilities available for the ***Route*** controllers. For this reason you may find that some of the software issued prior to the release of this manual, may not support all the functions described within this manual.

We do however attempt to continuously revise earlier versions of the software to ensure that all functions and revision of such functions are always available. Such revised software together with their manuals do become available from time to time, and will either be issued on request, or issued when we are of opinion that such improvements will have an effect on the successful operation of the system.

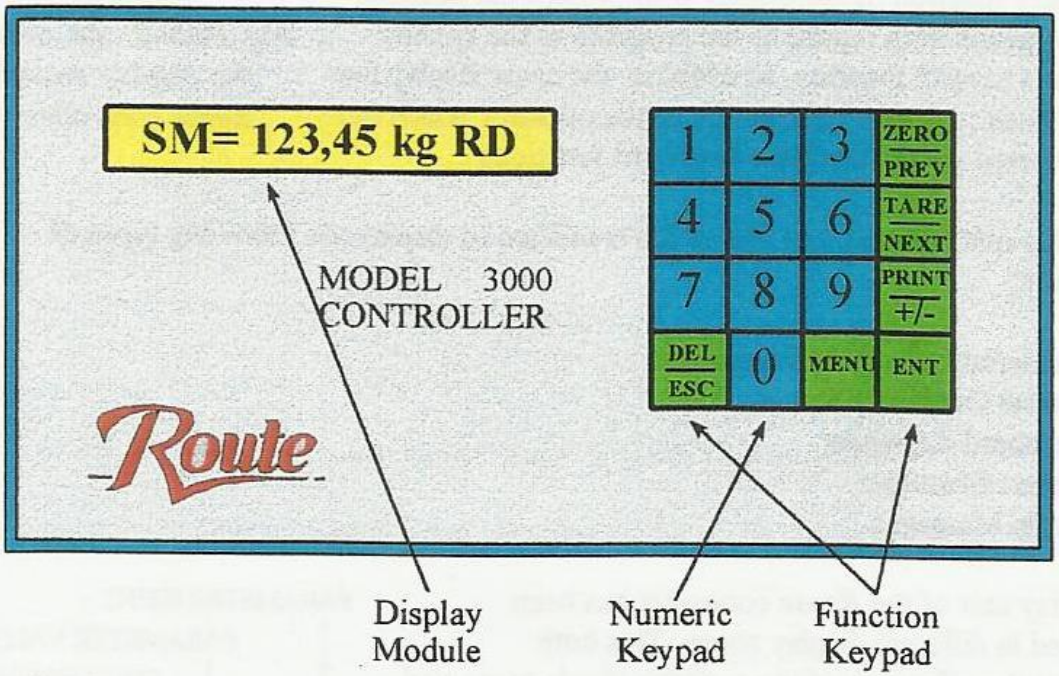

*Fig PAN-1: An overview of the front panel of the **Route** controller indicating it's major components.*

The major components of the ***Route*** controller's front panel, each with it's own functions and characteristics, are:

- **Display:** Single line, 16 character, backlit LCD display.
- **Keyboard:** 16 key, mechanical switch, matrix keypad.

These components are indicated in *Fig PAN-1*.

The front panel of the ***Route*** controller also includes some less obvious components (*situated on the display interface card itself*) which are;

- 8 Function LED's
- System Controlled Calibration Switch
- System Controlled Manual Switch

Each of these components and it's functions are discussed in the remainder of this manual.

2 Display Module

The display unit of the ***Route*** controller is a 16 character dot matrix LCD display with LED backlighting. The display unit has only one line of 16 characters as indicated in *Fig PAN-2*.

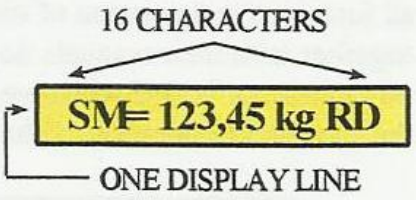

Fig PAN-2: *An overview of the display module of the* ***Route*** *controller.*

The primary function of the display is to present the operator with information with regard to the progress of the system through it's control function. In addition, the same display line is also utilized to return information to the operator which has been requested via the available keyboard functions.

The display unit has only one line which is utilized to display the following types of information;

- Measured/Calculated Parameters
- System Operating Status
- Keyboard Activities
- System Messages
- Alarm Messages

The display unit of the ***Route*** controller has been subdivided in different display zones. This both maximizes the efficiency of the available display area and provides uniformity across the range of ***Route*** controllers. The different display zones, as indicated in *Fig PAN-3*, are;

- Parameter Identification
- Parameter Value
- Engineering Unit
- System Status

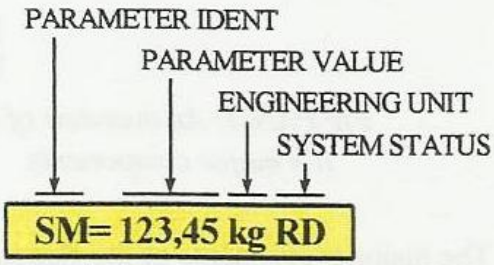

Fig PAN-3: An overview of the display module indicating the different display zones.

2.1 Default Display

The default display of the ***Route*** controller presents the operator with information with regards to the system's control function. Normally this information is a combination of a parameter value and the system control status.

2.1.1 Parameters

Parameters displayed in the default display mode normally results from values which are either measured or derived from other parameters during normal operation of the system.

Typically these parameters may be any of the following;

- Measured weight, torque, time, etc.
- Calculated feed rate, flow rate, speed, frequency, etc.

The parameters that are available for display depends on the requirements of a specific application. Normally, more than one parameter are available for display. Only one of the available parameters can be displayed at a time.

Selection of the parameters is done by depressing either the **[NEXT]**, **[PREV]**, **[ENTER]**, **[DEL]** or any of the numeric keys. Pressing any of the keys mentioned above allows scrolling through the parameters until the desired parameter is displayed. A selected parameter will stay active on the display until a new parameter is selected for display. A list of parameters available for display is available in the *APL-section* of the *Applications Manual*.

As indicated in *Fig PAN-3*, the all parameters normally conform to the following format:

SM=1234,5 kg

The different sections of the parameter are identified as;

- Parameter Ident : **SM**
- Parameter Value : **1234,5**
- Engineering Unit : **kg**

2.1.1.1 Parameter Identification

The parameter identification (*parameter ID for short*) identifies the parameter value currently being displayed. Since more than one parameter may be available for display, each parameter is assigned it's own unique parameter ID. This ID is used to differentiate between the different parameters.

The parameter ID normally consists of two alpha-numeric characters which are displayed in

the left-hand corner of the display unit as indicated in *Fig PAN-3*.

2.1.1.2 Parameter Value

The parameter value indicates the sign and magnitude of the parameter being displayed.

The parameter normally occupies seven display positions, including the decimal comma and sign character. The parameter value is placed as to directly follow the parameter's ID, ie., display positions four through to ten. The third display position is normally occupied by the equals sign (*ie.*, "=").

Unless otherwise indicated, the operating range of the parameter value (*ignoring the decimal comma*) is limited to between -32768 and +32767. This range may be extended if required by the application, to occupy all seven display position of the parameter value. This allows for up to six digits (*seven digits if the decimal comma is omitted*) to be used for the parameter value.

2.1.1.3 Engineering Unit

The engineering unit defines the unit of measurement which is applicable to the parameter being displayed. An engineering unit is always associated with a specific parameter value and may differ from parameter to parameter.

The engineering unit of each of the displayable parameters are normally user programmable and is selected from a list of pre-defined engineering units for the type of parameter concerned. The range of engineering units available for each parameter depends on the type of parameter concerned.

All engineering units are limited to four displayable characters. This limitation is suitable for most engineering units. The engineering unit of a parameter is displayed directly following the displayed parameter value, occupying display positions eleven through fourteen as indicated in *Fig PAN-3*.

Note: *The type of engineering unit applicable to each of the parameters is supplied together with the list of available parameters in the APL-section of the Applications Manual.*

2.1.1.4 Selection of Parameters

For each application, a fixed set of parameters are defined. From the available parameters, the operator may select the most suitable parameter for his requirements.

Selection of a parameter for display, may me done in one of the following manners;

- Scroll through the available parameters by depressing any one of the following keys;

[ENTER], [DELETE], [NEXT] or **[PREV]** keys.
- Directly select a parameter for display by means of the numeric keys.

Once a parameter has been selected for display, it will stay active until another parameter is selected.

In some instances, a specific parameter may have been defined as a default parameter. When this is the case, the default parameter will always return to the display once the keyboard activities have been terminated.

Note: *The selection of a parameter for display is only allowed whilst the display is in the default display mode, ie., a parameter is visible on the display.*
*A list of all parameters available for display for your application is supplied in the **APL-section of the Applications Manual**.*

2.1.2 System Status

The function of the status symbol is to confirm the progress of the system through the control process.

Each control function within the process is divided into smaller tasks known as phases or stages. For example, when you make coffee, you may perform the following tasks to get to your enjoyable cup of coffee.

- Ensure the kettle is filled with water
- Switch on the kettle
- Get a clean cup from the cupboard
- Put one spoon of coffee in the cup
- Put two spoons of sugar in the cup
- Once the water has been boiled, fill the cup with water
- Add milk to taste
- Stir well and enjoy

If you had visitors, there are basically two ways in which you could assure them that you have not left them during the long wait;

- You could invite them with you to the kitchen so they can see what you're doing
- You could put a set of lights, display board or other in the lounge to allow you to signal your progress to your visitors.

When working with controllers, the former is not practical, therefor we have to settle for the latter. By assigning a status symbol to each of the stages within an objective, you can tell what the controller is doing or expecting by observing the control status symbols.

For each application a predefined set of control status symbols exists which indicates the progress of the system through the control process.

Each control status symbol consists of two alpha-numeric characters which is displayed in the right hand corner of the display unit, ie., display positions fifteen and sixteen as indicated in *Fig PAN-3*.

During alarm conditions, the control status symbol is flashed to indicate the presence of an alarm condition.

Note: A set of system status symbols defined for your application is available together with their meaning in the APL-section of the Applications Manual.

2.2 Keyboard Activities

Keyboard activities takes precedence over all other activities on the display unit. Keyboard activities broadly defines all activities which are performed as a result of one or more key depressions or requires keystrokes to continue.

Depending on the requirement of the defined functions or application, the keys on the keyboard may be combined to for a keyboard request. A keyboard request is a pre-defined group of keys which will, when activated in a pre-defined order, request the system to perform a pre-defined function.

Functions defined for the ***Route*** controller may be classified into one of two types which are;

- An entry function (*ie., a request for information to be entered into the memory of the system*)
- An enquiry function (ie., a *request for information to be supplied by the system*)

A keyboard request will in most cases be followed by a response which may, depending on the request, either be:

- A key definition being displayed upon a key depression
- A request for more information by the requested function
- Information being supplied by the requested function

The response received from the system as a result of a function, depends on the implementation of the function itself. Although most functions are uniform across all applications, some functions are application dependent and may vary.

2.2.1 Key Response

Whenever a key is depressed and it is accepted by the system as a valid key under the

circumstances, the system will respond to the key depression in one of the following manners:

- If the key in the context of the entry forms a complete function request, the system executes or performs the requested function or task.
- If the key in the context of the entry forms part of a function request (*ie., further key strokes are required to form a complete function request*), the system responds by displaying the key definition as imprinted on the keypad.

2.2.2 Information Request

An information request is a request issued by the system in response to a function or action that allows data to be entered into the memory of the system.

Information requests are normally issued by entry type functions when more than one parameter value is required or may be entered during the execution of the function in question. Functions which falls into this category includes:

- Entry of set point values
- Pre-setting of system variables
- Programming the date & time
- Programming of the serial ports

2.2.3 Information Display

An information display is a response which returns information to the operator after an enquiry function has been activated. Functions which falls into this category are:

- Display of set point values
- Display of the date and time
- Display of totalisers

Although some functions only allow the values being displayed to be observed, most functions are dual functions, ie., will also allow values to be changed while being observed. The most common of the dual type functions are the set point functions.

2.3 System Messages

System messages carries the lowest priority of all the activities scheduled for the display unit. A system message is displayed as a result of the system operation to either:

- Inform the operator of actions required from him , or
- Indicate fault conditions that have been detected during the control process.

Generally system messages falls into two categories which are:

- Warning Messages
- Alarm Messages

System messages are not pre-defined as warning or alarm messages. The circumstances under which a condition occurs is evaluated before it's decided whether a warning message should be issued or an alarm be raised and whether the condition should also be reported to the on-line printer.

All system messages are self clearing, ie., the warning or alarm condition is removed once the conditions that caused the alarm returns to normal.

Note: A set of warning/alarm messages as defined for your application may be found in the APL-section of the Applications Manual. Further information regarding system messages may be found in the MES-section of the Calibration and Setup Manual.

2.3.1 Warning Messages

A warning message is a message which is issued to warn the operator of specific conditions that may exist during system operation that needs the attention of the operator. Warning messages are identified on both the display and printer by a trailing exclamation mark "!" for example:

Waiting for Zero!

Conditions under which the system may issue a warning message includes:

- Improper system operation by the operator
- Delays in system operation while the system is waiting for action from the operator

2.3.2 Alarm Messages

An alarm messages are messages which are issued to warn the operator of conditions that may exist during system operation which prevent's the system from completing it's task. Alarm messages are identified on both the display and the printer by a trailing asterisk ("*") for example:

High Zero Level*

For most applications the alarm message will be accompanied by at least a flashing control status symbol. An addition, an external alarm message may be activated if the I/O count allows.

Conditions under which the system may activate alarms include:

- Illegal conditions which arise during system operation such as gates or valves which are either not open or closed when required, or motors which trip during operation.
- Checksum errors in the systems operating parameters for example the selected recipe or set point.

3 Function LED's

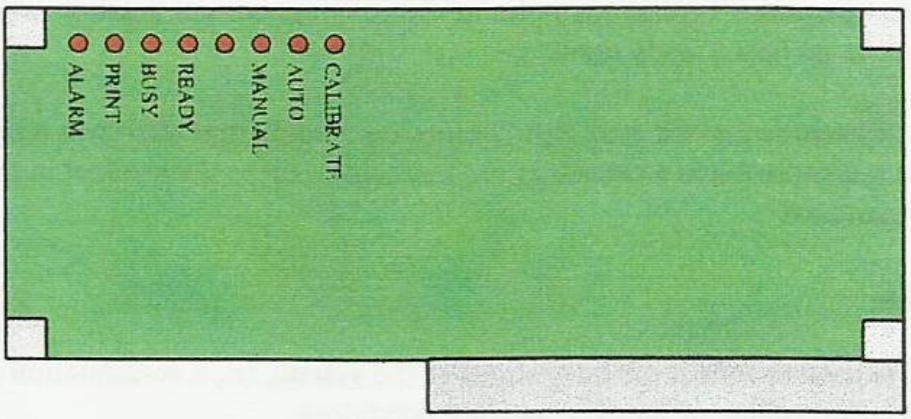

Fig PAN-4: An overview of the display interface card indicating the approximate location of the LED function indicators.

The ***Route*** controller has eight function LED indicators located on the display card itself and is not visible during normal operation. The function LED's provides a visual confirmation of system activities and therefor assist with quick system diagnostics. *Fig PAN-4* indicates the location of the function LED's on the display card. Each of the LED's has a predefined function which are:

- **READY** - Ready for normal operation to resume (*ie., Ready to start feed, unloading, etc.*)
- **BUSY** - Busy with normal operation (*ie., batching, feeding, unloading, etc.*)
- **PRINT** - Printing or communications channels are active. The print light indicates that any one of the communication ports still have data to be transmitted.
- **ALARM** - Alarm conditions are present. This is accompanied by alarm messages which will be displayed on the display unit.
- **AUTO** - The system is in the auto mode, ie., the system controlled manual switch is not active (*for more info refer to **Function Switch** later in this manual*)
- **MANUAL** - The system is switch into the manual mode by the system controlled manual switch. This normally only happens during startup (*for more info refer to **Function Switch** later in this manual*)
- **CALIB** - The system controlled calibration switch is active (*for more info refer to **Function Switch** later in this manual*)

3.1 Ready LED

The Ready LED is used to reflect the ready status of the system, ie., a confirmation that the system is not actively controlling or monitoring. Although the Ready LED is normally lit when the system displays the Ready Symbol (*RD*) on the display unit, it does only reflect the *RD* symbol.

Although the implementation of the Ready LED depends on the requirements of the application, it normally indicates the external input is required before the system will start or continue with an operation. Typical examples of stages in the control function which will cause the system to go into a ready mode are:

- When the system requires a start input before the feeding operation will be started.
- When the system requires a discharge request signal before the product in the weigh bin will be discharged.

3.2 Busy LED

The Busy LED is used to reflect the busy status of the system, ie., a confirmation that the system is actively controlling or monitoring plant conditions.

Although the implementation of the Busy LED depends on the requirements of the application, it normally indicates that the control operation is in progress. Typically, the Busy LED will be lit under the following conditions:

- When the system is feeding or batching the product requested.
- When the system discharge the batched product.

3.3 Print LED

The Print LED is used to reflect active communication on any of the communication ports. The Print LED is lit when any of the communication port's outgoing buffer contains data to be transmitted.

The duration for which the Print LED will be lit depends on both the baud rate and the amount of data to be transmitted. When the Print LED stays lit for extensive periods, it is normally and indication of either incorrect serial port configuration or a complete communications failure on one of the communication ports.

3.4 Alarm LED

The Alarm LED is used to reflect the alarm status of the system. The Alarm LED is lit when any alarm condition is present within the system. The Alarm LED reflects both internal and external alarm conditions.

When an alarm condition exists, the following actions are normally taken:

- The Alarm LED will be lit
- The system's status symbol will flash
- An external alarm may sound of provided for and fitted
- The relevant alarm message will flash on the display unit if no keyboard functions are active
- Depending on the nature of the alarm condition and the requirements of the application, the control function may be paused until the alarm condition is cleared

3.5 Auto LED

The Auto LED is used to reflect the Auto status of the Auto/Manual switch which is controlled by the system. The system normally switches to Manual during startup and will switch back to Auto after successful startup.

During normal operation the system may switch back to Manual if operating conditions are undesirable or when the CPU fails.

When switched to Auto, the CPU has normal control of all functions.

3.6 Manual LED

The Manual LED is used to reflect the Manual status of the Auto/Manual switch which is controlled by the system. The system normally switches to Manual during startup and will switch back to Auto after successful startup.

During normal operation the system may switch back to Manual if operating conditions are undesirable or when the CPU fails.

When switched to Manual, all output functions are removed from the control of the CPU and switched to a default fail save state.

3.7 Calibrate LED

The Calibrate LED is used to reflect the status of the system controlled calibration switch which allows access to the calibration and setup memory.

The system normally automatically opens the Calibration switch whenever access to the Calibration and Setup Memory is required.

4 Function Switch

The ***Route*** controller is fitted with both Auto/Manual and Calibration switches which are

located on the display module of the controller and are under complete control of the system. Beside the Calibration switch, the system also features a Calibration Lock-out link which prevents all access to the calibration values of the system.

4.1 Auto/Manual Switch

The ***Route*** controller is fitted with an Auto/Manual switch located on the display module of the controller and is under the complete control of the system

4.1.1 Auto Switch Position

The Auto switch position of the Auto/Manual switch allows the system complete control of the output functions such as the output relays and analog outputs.

During normal operation the system will always be switched to Auto unless the operating conditions becomes undesirable or the CPU fails which will cause the system to be switched to Manual automatically.

4.1.2 Manual Switch Position

The Manual switch position of the Auto/Manual switch prevents the system of having control over any of the output functions such as the output relays and analog outputs.

The system normally switches to Manual during power up or when the operating conditions becomes undesirable. When switch to Manual, all output functions are taken to a fail save mode which is dip-switch programmable.

4.2 Calibration Switch

The Calibration switch is used to allow the system access to the key-switch protected setup and calibration memory which is used for storage of the calibration and setup parameters. The Calibration switch must be switched before the system has access to the write to the calibration and setup memory.

Whenever the system requires to store acquired setup or calibration parameters, it requests access to the calibration an setup memory. If all conditions are normal, the calibration switch is activated and the system stores the parameters after which the switch will be returned to the normally closed position.

The Calibration switch normally locks out automatically during system power up or when conditions are undesirable for normal operation to proceed.

4.3 Calibration Lock-out Link

The *Route* controller features a Calibration Lock-out link on the main board which prevents all access to the calibration memory even when the Calibration switch is activated. The approximate position on this link on the main board is indicated in *Fig PAN-5*.

When the Calibration Lock-out link is removed from the main board, the system will not have any access to the Calibration memory to store or alter any values that effects the calibration of the system. When functions are executed which requires access to the calibration memory and the calibration lock-out link is removed, the system will display the message:

Assize Lockout!

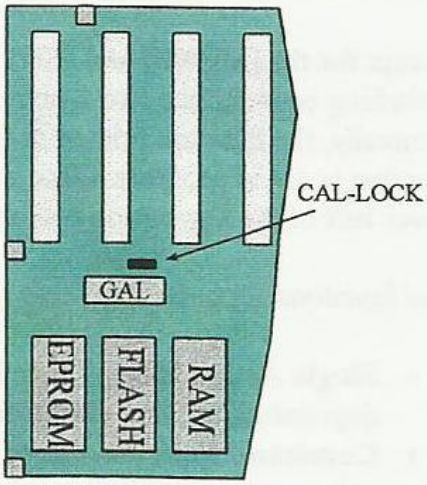

*Fig PAN-5: A section of the main board of the **Route** controller indicating the approximate position of the Calibration Lock*

5 Keyboard

The *Route* controller features a sixteen key matrix keyboard which is used to issue instructions to the system. As indicated by the colors of the keyboard, see *Fig PAN-6*, the sixteen keys of the keyboard are divided into two main groups which are:

- Numeric Keypad (*colored blue*)
- Function Keypad (*colored green*)

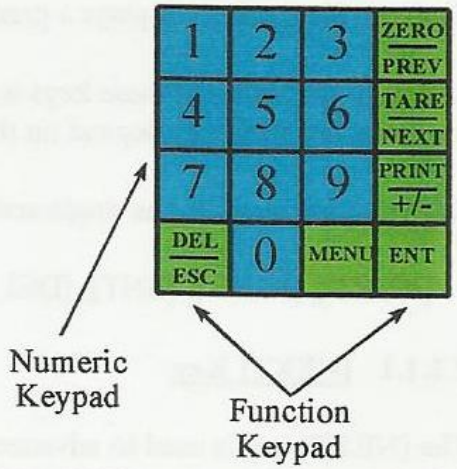

*Fig PAN-6: An overview of the keypad of the **Route** controller.*

5.1 Numeric Keypad

Depending on the context within which the numeric keys are used, the numeric keypad may be used to either:

- **Enter parameter values into the system**. When parameter values are displayed, they may be altered by simply entering the new value.
- **Specify sub-functions and channel numbers**. During command entry, the numeric keys are used to specify a sub-function or channel number upon which the command is to act.
- **To select the default display parameter on the display unit**. Used on it's own, ie., when no keyboard functions are active, the numeric keys will select the default parameter for display on the display unit of the *Route* controller.

5.2 Function Keys

The ***Route*** controller's keyboard features six function keys.

Except for the [MENU] and [ENT] keys, all other function keys support two functions each. Switching between the two functions of a key is automatic and transparent to the operator. Generally, the function printed in the upper half of the key button is active when a command function is not in progress. Once a command function takes control, the function printed in the lower half of the key button becomes active.

The functions supported by these keys can be divided into two main categories:

- **Single Action Keys**: Those keys which allows to system to take immediate action after depression, ie., they do not form part of any command sequence.
- **Command Function Keys**: Those keys which form part of a command sequence.

5.2.1 Single Action Keys

The single action keys are those keys that will cause a pre-defined action to be taken by the system when they are depressed. These keys do not have any other form of visible feedback other than that produced as a result of the executed action. This is in contrast to the Command Function Keys which displays a predefined string on the screen with each depression.

Normally the action of these keys is independent of the other keys or the command function in progress, but they may depend on the current status of the system.

Keys that are classified as single action keys include:

[NEXT], [PREV], [ENT], [DEL], [ESC] and [+/-].

5.2.1.1 [NEXT] Key

The [NEXT] key is used to advance to the next parameter, value or position and is only active during keyboard command functions, ie., when a command is in progress.

5.2.1.2 [PREV] Key

The [PREV] key is used to revert back to the previous parameter, value or position and is only active during keyboard command functions, ie., when a command is in progress.

5.2.1.3 [ENT] Key

The [ENT] key is normally used to terminate a keyboard entry sequence or accept the value being displayed.

The [ENT] key will only have an effect under the following conditions:

- When the default parameter is visible on the display unit in which case the [ENT] key will allow scrolling true the available parameters on the display unit.
- After entering a keyboard sequence to signal the end of the sequence and to allow the entered sequence to be processed.
- After entering a parameter's new value to allow the entered value to be stored.
- When a parameter's value is displayed to accept the displayed value as the default.

5.2.1.4 [DEL/ESC] Key

The [DEL/ESC] key is a multi-function key. It's function depends on the current status of the system and are summarized as follows:

- When the default display parameter is active, the [DEL/ESC] key will scroll through the available display parameters in reverse order. The display parameter selected last, will become the new default display parameter.
- During a command entry sequence, the [DEL/ESC] key deletes the last entered key stroke.
- During parameter value entries, the [DEL/ESC] key will delete the value entry, provided the [ENT] key has not been depressed.
- Within command functions, the [DEL/ESC] key allows an escape from the command function.
- Within the menu function, the [DEL/ESC] key will return to the previous menu level.

5.2.1.5 [+/-] Key

The [+/-] key is only active during command functions. It's uses may be summarized as follows:

- During value entries, the [+/-] key changes the sign of the value being entered.
- Some set point values are stored in a non-signed format. When viewing these values, the [+/-] key may be used to reveal the sign of such values.
- Within the test functions, the [+/-] key may be used to switch between the monitor and override modes.

5.2.2 Command Functions

The Command Function Keys are those keys that normally forms part of command sequence entries only. As the ***Route*** controller is primarily a menu driven system, only the basic functions are supported with separate function keys. Keys that are classified as Command Function Keys include:

[MENU], [ZERO], [TARE] and [PRINT]

These keys are normally only used as part of an initial command entry, ie., to select a specific

command function.

When depressing these keys, a key definition will be displayed that reflects the imprint on the key-pad overlay on the display unit.

5.2.2.1 [MENU] Key

The [MENU] key is used to activate the menu system of the ***Route*** controller. The menu system provides access to all the functions of the ***Route*** controller through menus and sub-menus.

*Note: For more detail on the menu system, refer to the **Menu System** later in this manual.*

5.2.2.2 [ZERO] Key

The [ZERO] key is used to perform the operators zero function, ie., zero the scale. The limits within which the zero may be performed are defined by the *ZeroRnge* set point under calibrations set points (*refer **Calibration Setpoints in the CAL-section of the Setup and Calibrations Manual***).

The basic uses of the [ZERO] key includes:

- [ZERO][ENT] - Perform *Zero Adjustment* on analog input #1 (*normally Load Cell I/P #1*)
- [ZERO][1][ENT] - Perform *Zero Adjustment* on analog input #1 (*normally Load Cell I/P #1*)
- [ZERO][2][ENT] - Perform *Zero Adjustment* on analog input #2 (*normally 4-20 mA/0-10 V I/P #1*)

*Note: For more information on Zero Calibration and Adjustment refer to the **CAL-section of the Setup and Calibration Manual**.*

5.2.2.3 [TARE] Key

The [TARE] key is used to perform a tare on the specified analog input channel.

The Tare Function allows the system to record the tare value of the scale and return the display to zero. This is normally only used for manual filling scales, and therefor will have no effect unless required and implemented for a specific application.

The basic uses of the [TARE] key includes:

- [TARE][ENT] - Tare analog input #1 (*normally Load Cell #1*)
- [TARE][1][ENT] - Tare analog input #1 (*normally Load Cell #1*)

- [TARE][2][ENT] - Tare analog input #2 (*normally 4-20 mA/0-10 V I/P #1)*

*Note: For more information on the implementation of the tare function, refer to the **Operators Manual** supplied with your **Route** controller.*

5.2.2.4 [PRINT] Key

The [PRINT] key is used to manually activate the management reporting facilities, even though the management reporting system is primarily and automated system, ie., will generate reports automatically.

Some basic uses of the [PRINT] key includes:

- [PRINT][ENT] - Activate the *Event Report* and clear it's totalisers.
- [PRINT][1][ENT] - Activate the *Event Report* without clearing it's totalisers.
- [PRINT][2][ENT] - Activate the *Batch Report* without clearing it's totalisers.

*Note: The [PRINT][ENT] is the only manually requested function that will also clear the totalisers after the report has been completed. For more information on Management Reports and printer related functions refer the **REP-section** of the **Setup and Calibration Manual**.*

6 Menu System

The ***Route*** controller is primarily a menu driven system, therefor only a limit number of functions are available directly from the keyboard. All other functions are supported only by the menu system. For ease of reference, *Table PAN-1* at the end of this document provides a summary of the menu system.

With the menu system, related functions within the ***Route*** controller are grouped together to form the basic menu options. Where a menu function may be considered as part of more than one group, branches to the same function has been created under all those groups. The basic menu options, each with it's own sub-menus of functions, are:

- Set Points
- Display Functions
- Print Functions
- Calibration
- Setup Functions
- Test Functions
- I/O Assignment

The menu systems is activated simply by entering the following key sequence:

[MENU][ENT]

Navigation through the menu system is primarily done by the following keys:

- [ENT] - Selecting a menu option
- [ESC] - Returning to the previous menu level
- [NEXT], [PREV] - Scrolling through the menu options.

6.1 Setpoints

The Setpoints menu option groups all set point related functions together. Menu options contained within the Setpoints menu are:

- Target Setpt's
- Operating Setpt's
- Calibrate Setpt's
- Totaliser Setpt's
- Printer Setpt's

6.1.1 Target Setpt's

The Target Setpt's menu function allows the target related settings to be specified. The parameters of this function is highly application dependant, but normally include:

- Selection of a product
- Specification of a target mass.

*Note: For more information on the parameters of this function, refer to the **TRG-section** of the **Applications Manual**.*

6.1.2 Operating Setpt's

The Operating Setpt's menu function allows programming of those set points which defines the operating conditions of the ***Route*** controller such as delay times, limits, levels, minimum and maximum values, etc. The parameters of this function is highly application dependant.

*Note: For more information on the parameters of this function, refer to the **APL-section** of the **Applications Manual**.*

6.1.3 Calibrate Setpt's

The Calibrate Setpt's menu function allows programming of those set points which defines the calibration requirements of each of the analog input channels (*both Load Cell and 4-20 mA/0-10 V analog inputs*).

By default, the parameters of analog input #1 (*normally Load Cell input*) will be accessed if this function is selected with the [ENT] key. If any of the other analog input channels are required, it has to be specified by selecting the menu option by specifying the channel number, ie., [1], [2], [3], etc. The channel numbers assigned to the analog inputs are specified under *Analog Inputs* in both the *APL-section* and *COM-section* of the *Applications Manual.*

*Note: For more information on the parameters of this function, refer to the **CAL-section** of the **Setup and Calibration Manual**.*

6.1.4 Totaliser Setpt's

The Totaliser Setpt's menu function allows programming of those set points which defines the totaliser requirements of your application. The parameters of this function are limited to Engineering Units end Totaliser Resolution.

*Note: For more information on the parameters of this function, refer to the **TOT-section** of the **Setup and Calibration Manual**.*

6.1.5 Printer Setpt's

The Printer Setpt's menu function allows programming of those set points which defines the printing requirements of your application. The parameters of this function include Shift Times for automatic reporting, printer codes, auto reporting requirements, etc.

*Note: For more information on the parameters of this function, refer to the **REP-section** of the **Setup and Calibration Manual**.*

6.2 Display Functions

The Display Functions menu option groups all display related functions together. Menu options contained within this menu are:

- Totalisers
- Stock Levels
- Reset Totalisers
- Print Buffer
- View Alarms

6.2.1 Totalisers

A separate totaliser is maintained at nine different levels for each product defined within the system. The Totalisers menu option allow the viewing of the system totalisers.

By default, the bottom level (*ie., Event Totaliser*) totalisers are displayed. From this point on,

we may scroll through all the remaining totalisers by utilizing the [NEXT] and [PREV] keys.

We may however, start the totaliser display at any of the nine defined levels, ie., Batch, Shift, Daily, Weekly, etc. by selecting the total display function with the appropriate numeric equivalent of the level concerned, instead of the [ENT] key. For example, to start viewing the daily totalisers, we may press the [4] key, instead of the [ENT] key.

*Note: For more information about the totalisers and the different levels of totalisers, refer to the **TOT-section in the Setup and Calibration Manual**.*

6.2.2 Stock Levels

A stock level totaliser is maintained for each product defined within the system. This menu function allows the stock levels to be cleared, preset, added to, and viewed.

*Note: For more information on the stock levels, refer to the **TOT-section in the Setup and Calibration Manual**.*

6.2.3 Reset Totalisers

A separate totaliser is maintained at nine different levels for each product defined within the system. The Reset Totalisers menu function, allows resetting of the totalisers either globally, or at any of the defined levels.

By default, all totalisers will be reset when this menu option is selected with the [ENT] key. However, when selecting this menu option with the equivalent numeric key of a totaliser level, it is possible to clear only one specific level instead of all totalisers. For example, to clear only the daily totalisers, this menu option has to be selected with the [4] key instead of the [ENT] key.

*Note: For more information on the totalisers and the resetting thereof, refer to the **TOT-section in the Setup and Calibration Manual**.*

6.2.4 Print Buffer

When reports are spooled to the printer, the report is generated and placed in a print spool buffer from where it is transmitted via the RS-232 port to the printer. The Print Buffer menu option (*which truly is only needed for fault finding*) allows viewing of the print spool buffer.

6.2.5 View Alarms

The View Alarms menu option only allows viewing of the alarm screen.

6.2.6 S/W Revision

The S/W Revision menu option allows viewing the installed software's type, release and version numbers.

6.3 Print Functions

The Print Functions menu option groups all print related functions together. Menu options contained within this menu are:

- Print Report
- Print Targets
- Print Setpt's

6.3.1 Print Report

The ***Route*** controller maintains a separate totaliser at nine different levels for each product defined. Both manually requested and automated management reports are generated based on the nine levels defined which include the hourly, shift, daily, weekly, monthly, yearly, etc. levels.

The Print Report menu option allows the reports to be requested manually.

By default, the bottom level report (*ie., Event Report*) will be generated when this menu option is selected with the [ENT] key. However, a report may be requested for any of the pre-defined levels if this menu option is selected with the numerical equivalent of the level required. For example, to request the daily report, the menu option has to be selected pressing the [4] key instead of the [ENT] key.

*Note: For more information on the defined levels and the reports that are generated for each level, refer to the **REP-section of the Setup and Calibration Manual**.*

6.3.2 Print Targets

The Print Target menu option allows the current target setting, ie., product and mass, etc., to be printed by manual request. This report may also be enabled for automatic printing.

*Note: For more information of the automated reports, refer to the **REP-section of the Setup and Calibration Manual**.*

6.3.3 Print Setpt's

The Print Setpt's menu option allows the printing of set points and setup parameters.

6.4 Calibration

The Calibration menu option groups all calibration functions together. Since all calibration functions available for the analog inputs are not available for the analog outputs, this menu option separates these two from each other. Menu options available within this menu are:

- Analog I/P
- Analog O/P

6.4.1 Analog I/P

The Analog I/P Calibration menu option groups all calibration functions for the analog inputs together.

By default, the calibration functions for the first analog input, normally the load cell channel, are selected. It is also possible to select any of the other analog inputs by accepting this menu option with the numeric key equivalent of the analog input channel to be calibrated, for example: the [2] key will select the calibration functions of the second analog input channel.

*Note: For a list of the available analog input channels and there equivalent channel numbers, refer to **Analog Inputs** in either the **APL-section** or the **COM-section** of the **Applications Manual**.*

Menu options available within this menu are:

- Calibr. Setpt's
- Zero Calibr.
- Span Calibr.
- Linearize
- Span Correct
- A/D Zero Adjust
- A/D Gain Adjust

6.4.1.1 Calibr. Setpt's

The Calibrate Setpt's menu function allows programming of those set points which defines the calibration requirements of the selected analog input channel.

*Note: For more information on the parameters of this function, refer to the **CAL-section** of the **Setup and Calibration Manual**.*

6.4.1.2 Zero Calibr.

The Zero Calibr. menu option allows zero calibration of the selected analog input channel.

The zero calibration function records the empty weight of the scale and stores this value as part of the calibration set points of the selected analog input channel.

*Note: For more information on the calibration functions, refer to the CAL-section of the **Setup and Calibration Manual**.*

6.4.1.3 Span Calibr.

The Span Calibr. menu option allows span calibration of the selected analog input channel.

The span calibration function records the slope of the analog input signal in terms of millivolts response against the test weight. These two values are stored as part of the calibration set points of the selected analog input channel.

*Note: For more information on the calibration functions, refer to the CAL-section of the **Setup and Calibration Manual**.*

6.4.1.4 Linearize

The Linearize menu option allows linearization of the selected analog input channel.

Linearization is required only when the response of the sensor (*in most cases a load cell*) is not linear when the measurand (*in most cases force*) is applied to the sensor.

The linearize function allows incremental span calibration of the analog input, ie., the response of the analog input is recorded for multiple load points.

*Note: For more information on linearization, refer to **Linearization** in the CAL-section of the **Setup and Calibration Manual** .*

6.4.1.5 Span Correct

The Span Correct menu option allows a constant span correction to be applied to the selected analog input signal.

The span correction function calculates and applies a constant gain factor to the selected analog input signal. This is only required when there is a constant difference between the static and dynamic response of the measuring device.

This function is particularly useful on overhead crane scale applications where the load cell and instrumentation are factory calibrated. With overhead cranes the load cell does not carry the full load lifted by the crane, since the load hook is suspended on multiple loops of the rope, some of which are not sensed by the load cell. The applied gain factor allows the analog input to be compensated for this and produce the correct output.

Note: For more information on span correction, refer to the CAL-section in the Setup and Calibration Manual.

6.4.1.6 A/D Zero Adjust

The A/D Zero Adjust menu option allows adjustment of the analog to digital converters zero offset as a result of the applied dead load. This differs from the Zero Calibration function which only records the dead load offset.

The A/D Zero Adjustment function electronically adjusts the zero offset of the analog to digital converted. This function only need be performed when:

- a load cell with a sensitivity of greater than 2 mV/V is used,
- the load cell might be used to near full capacity,
- the A/D converters gain need be adjusted for greater sensitivity.

Note: This function does not eliminate the need to perform zero calibration. For more information on the A/D Zero Adjustment function, refer to the CAL-section of the Setup and Calibration Manual.

6.4.1.7 A/D Gain Adjust

The A/D Gain Adjust menu option allows adjustment of the analog to digital converter's gain. This is only required when:

- a load cell with a sensitivity other than 2 mV/V is used,
- greater sensitivity is required from the analog input channel.

Note: This function does not eliminate the need to perform a span calibration. For more information on the A/D Gain Adjustment function, refer to the CAL-section of the Setup and Calibration Manual.

6.4.2 Analog O/P

The Analog O/P Calibration menu option groups all calibration functions for the analog outputs together.

By default, the calibration functions for the first analog output are selected. It is also possible to select any of the other analog outputs by accepting this menu option with the numeric key equivalent of the analog output channel to be calibration, for example: the [2] key will select the calibration functions of the second analog output channel.

Note: For a list of the available analog output channels and there equivalent channel numbers, refer to the Analog outputs in either the APL-section or the COM-section

of the Applications Manual.

Menu options available within this menu are:

- Zero Calibr.
- Span Calibr.

6.4.2.1 Zero Calibr.

The Zero Calibr. menu option allows zero calibration of the selected analog output.

The zero calibration function adjusts the 0/4 mA (*0 V in the case of 0-10 V operation*) point of the analog output.

6.4.2.2 Span Calibr.

The Span Calibr. menu option allows gain calibration of the selected analog output. The span value for the analog output are normally set by the *MassScal* set point under the *Operational Setpoints* (*see Application Setpoints in the APL-section of the Applications Manual*).

The span calibration functions adjusts the 20 mA (*10 V in the case of 0-10 V operation*) point of the analog output.

6.5 Setup Functions

The Setup Functions menu option groups all setup related functions together. Menu options contained within this menu are:

- Product Setup
- Date & Time
- Baud Rate

6.5.1 Product Setup

The Product Setup menu option allows programming of the system parameters such as pass words and product configuration parameters.

Although the Product Setup function is implementation dependent and may vary from application to application, it normally includes the following parameters:

- Operators Password
- No of Products for the Totalisers

6.5.2 Date & Time

The Date & Time menu option allows viewing/setting of the Date and Time.

6.5.3 Baud Rate

The Baud Rate menu option allows programming of the serial port parameters, ie., word length, baud rate, stop bits, etc. For more information on the programmable parameters of the serial ports, refer to the *CNF-section* in the *Setup and Calibration Manual*.

By default, the parameters of the first serial port is selected by this functions. By accepting this menu option with the numeric key equivalent of the serial port to be programmed, it is possible to select programming of the parameters of the other ports. For example: the [2] key will select the programming of the parameters of the second serial port.

Note: *For more information on the available serial ports and there channel numbers, refer to the COM-section of the Applications Manual.*

6.6 Test Functions

The Test Functions menu option groups all test related functions together. Menu options contained within this menu are:

- Operating Vars
- System Vars
- MODBUS Vars
- Printer Vars
- Analog I/P's
- Analog O/P's
- Digital I/P's
- Digital O/P's
- Comm Channel
- Display Test

6.6.1 Operating Vars

The Operating Vars menu option allows viewing of the operational variables. The operational variables are used by the system to store measured and calculated values.

Note: *For a list and explanation of the operational variables, refer to Application Variables in the APL-section of the Applications Manual.*

6.6.2 System Vars

The System Vars menu option allows viewing of the system variables. The system variables are used by the system to store the master clock and date & time control variables.

*Note: For a list and explanation of the system variables, refer to the **TST-section of the Setup and Calibration Manual**.*

6.6.3 MODBUS Vars

The MODBUS Vars menu option allows viewing of registers which is used specifically during MODBUS communications for exchange of information between the ***Route*** controller and PLC's, PC's, etc.

This menu option contains sub-menu to select the types of registers to be viewed which are:

- Input Status
- Output Status
- Input Registers
- Hold Registers

*Note: For more information on MODBUS communications and it's protocol, refer to the **MODBUS Reference Manual**.*

6.6.3.1 Input Status

The Input Status menu option allows viewing/testing of the input status registers communicated via MODBUS

6.6.3.2 Output Status

The Output Status menu option allows viewing/testing of the output status registers communicated via MODBUS.

6.6.3.3 Input Registers

The Input Registers menu option allows viewing of the input registers communicated via MODBUS.

6.6.3.4 Hold Registers

The Hold Registers menu option allows viewing of the output registers communicated via MODBUS.

6.6.4 Printer Vars

The Printer Vars menu option allows viewing of the registers used for printer control such as line counters, last hour report, last shift report, etc.

*Note: For more information on the printer variables, refer to the **REP-section of the Setup and Calibration Manual**.*

6.6.5 Analog I/P's

The Analog I/P's menu option allows viewing of the variables used for the processing of the selected analog input.

By default, the variables for the first analog input (*which normally is the load cell input*) are displayed. The variables for the other analog inputs may be viewed by accepting this menu option with the numeric key equivalent to the analog input's channel number which is to be viewed. For example: the [2] key will display the variables for the second analog input channel (*which normally is the first 4-20 mA input*).

*Note: For a list of the available analog inputs and their channel numbers, refer to **Analog Inputs in the APL-section of the Applications Manual**.*

6.6.6 Analog O/P's

The Analog O/P's menu option allows viewing and testing the performance of the selected analog output.

By default, the first analog output is selected for viewing. The other analog outputs may be viewed by selecting the menu option with the numeric key equivalent of the analog output number which requires viewing. For example: the [2] key will select the second analog output for viewing.

*Note: For more information on the testing of the analog outputs, refer to the **TST-section in the Setup and Calibration Manual**. For a list of the available analog outputs and their respective channel number, refer to **Analog Outputs in the APL-section of the Applications Manual**.*

6.6.7 Digital I/P's

The Digital I/P's menu option allows viewing and testing the of the selected digital input interface card.

By default, the first digital input interface card is selected for viewing. The other digital input interface cards (*if fitted*), may be selected by selecting this menu option with the numeric equivalent of the input interface card to be viewed. For example, the second digital input interface card may be viewed by selecting this menu option with the [2] key instead of the

[ENT] key.

Note: *For more information on the testing and viewing of the digital inputs, refer to the **TST-section of the Setup and Calibration Manual**.*

6.6.8 Digital O/P's

The Digital O/P menu option allows viewing and testing of the selected digital output interface card.

By default, the first digital output interface card is selected for viewing. The other digital output interface cards (*if fitted*), may be selected by selecting this menu option with the numeric equivalent of the digital output interface card to be viewed. For example, the second digital output interface card may be viewed by selecting this menu option with the [2] key instead of the [ENT] key.

Note: *For more information on the testing and viewing of the digital outputs, refer to the **TST-section of the Setup and Calibration Manual**.*

6.6.9 Comm Channel

The Comm Channel menu option allows viewing of the communications input and output buffers.

By default, the buffers of the first communications channel is selected for viewing. The buffers of the other communication channels may be selected by selecting this menu option with the numeric key equivalent of the communication channel's number. For example, the second communication channel's buffers may be selected by accepting this menu option with the [2] key instead of the [ENT] key.

Note: *For more information on the testing of the communication channels, refer to the **TST-section of the Setup and Calibration Manual**.*

6.6.10 Display Test

The Display Test menu option allows testing of the LCD display.

This function may be performed at any time. Other that overwriting the display with test patters for visual observation, this function does not effect the system or it's operation in any way.

Note: *For more information on the display test, refer to the **TST-section of the Setup and Calibration Manual**.*

6.7 I/O Assignment

I/O Assignment allows the end user to "connect" I/P's and O/P's to the I/O functions within the control procedure of the *Route* controller. Probably, re-assignment might be more correct, as by default all I/O functions are already assigned in a logical manner to I/P's and O/P's. The end user may change this default assignment or bypass certain I/O requirements.

The I/O Assignment menu option groups all I/O assignment functions together. Menu options contained within this menu are:

- Analog I/P
- Analog O/P
- Digital I/P
- Digital O/P

6.7.1 Analog I/P

The Analog I/P menu option allows re-assignment of the analog inputs.

6.7.2 Analog O/P

The Analog O/P menu option allows re-assignment of the analog outputs.

6.7.3 Digital I/P

The Digital I/P menu option allows re-assignment of the digital inputs.

6.7.4 Digital O/P

The Digital O/P menu option allows re-assignment of the digital outputs.

6.8 Flash Functions

The Flash Functions are reserved for factory testing of the onboard Flash memory and are normally excluded once a controller has been loaded with it's final software.

All flash functions are transparent to the end user.

7 Table PAN-1: Menu System

			Section
Setpoints	Target Setpt		TRG
	Operating Setp		APL
	Calibrate Setp		CAL
	Totalising Setp		TOT
	Printer Setp		PRN
Display Functions	Totalisers		TOT
	Stock Levels		TOT
	Reset Totals		TOT
	Print Buffer		PRN
	View Alarms		MES
	S/W Revision		-
Print Functions	Print Report		PRN
	Print Targets		PRN
	Print Setpt's		PRN
	Print Testing		PRN
Calibration	Analog I/P	Calibr. Setp's	CAL
		Zero Calibr.	CAL
		Span Calibr.	CAL
		Linearize	CAL
		Span Correct	CAL
		A/D Zero Adj.	CAL
		A/D Gain adj.	CAL
	Analog O/P	Zero Calibr.	CAL
		Span Calibr.	CAL

			Section
Setup Functions	Product Setup		TRG
	Date & Time		
	Baud Rate		COM
Test Functions	Operating Vars		APL
	System Vars		TST
	MODBUS Vars	Input Status	MOD
		Output Status	MOD
		Input Registers	MOD
		Hold Registers	MOD
	Printer Vars		PRN
	Analog I/P's		CAL
	Analog O/P's		TST
	Digital I/P's		TST
	Digital O/P's		TST
	Comm Channel		TST
	Display Test		TST
I/O Assignment	Analog I/P		TST
	Analog O/P		TST
	Digital I/P		TST
	Digital O/P		TST
Flash Functions	Program Flash		-
	Erase Flash		-
	Flash Inspect		

*Table PAN-1: A summary of the menu functions available for the **Route** controller*

Route

3000 - 7000

SERIES CONTROLLERS

CONTENTS

7 MES - System Messages - White

The section contains a discussion of the Alarm, Warning and Reply messages generated by the *Route Series Controllers*. A detailed explanation of each of the messages and the conditions under which they are generated is included.

Preface

Thank you for purchasing a ***Route** Series Controller*. Be assured that you have just bought the most advanced process controller available on the market today.

Due to an ongoing Research and Development programme (*both on the software and hardware*) we are able to offer you Tomorrows Technology today.

The ***Route** Controller's* reliability and flexibility allow it to handle all kinds of processes and operations in just about any industry. It is rugged enough for any industrial environment.

***Route** Controllers* have already been installed for use in a variety of applications such as:

* Belt Weighers
* Weigh Feeders
* Pre-Weigher (*Both Single and Dual Systems*)
* Batching Controllers
* Check Weighers
* Rail & Road Weigh Bridges (*Both Static and In-Motion*)
* Flask Weighers & Totalisers

The ***Route*** series of instruments is locally designed, manufactured and distributed by *Loadcell Systems (Pty.) Ltd*, trading as *Route Industrial Automation.*

The series of ***Route*** controllers currently consist of the following units:

* Route 3500 Transmitter-Indicator
* Route 4500 Filling/Batching Controller
* Route 4800 Belt Weigher
* Route 4850 Weigh Feeder
* Route 5000 Single Channel Batching Controller
* Route 5500 Dual Channel Batching Controller
* Route 6000 Multi-Channel Process Controller
* Route 7000 Multi-Channel Process Controller

The ***Route*** controllers have been designed to specifically cater for both the general and dedicated process control requirements.

Your ***Route*** controller has sophisticated application and control software, yet is easy and simple to operate. The ***Route*** controller offers extensive programming facilities to suit your very application. This feature makes it an invaluable tool in your factory.

We strive for operational and software compatibility throughout the complete range of ***Route*** controllers. This has the advantage that once you can operate one ***Route*** controller, you will be

able to operate all.

Since the ***Route*** series of instruments is 100% locally designed and manufactured, we are able to provide you with a complete backup service on all your ***Route*** equipment, at cost-effective rates and minimum lead time.

Each ***Route*** controller is carefully checked and subjected to comprehensive Quality Control tests. This includes the complete simulation of the actual application for which it is intended. Your system should start up and go without any problems!

Each ***Route*** controller is guaranteed for a period of 12 months, against faulty workmanship, provided that it was not electrically or mechanically mistreated. For further reference a copy of the conditions of sale and guarantee clause has been included hereafter.

In the case of any queries with regards to your ***Route*** controller, or any problems arising from the installation, you may contact any of the following persons on a 24-hour basis at the telephone numbers provided:

NAME	OFFICE HOURS	BASED AT
Fanie Smith	011-615-7068/9 082-600-8332 (Cell)	Johannesburg
Dr D J van Vuuren	011-615-7068/9 082-902-2331 (Cell)	Johannesburg
Stefan Spieker	031-83-3533 082-447-6996 (Cell)	Durban North
Anton Preiss	018-462-3812 082-651-6352 (Cell)	Klerksdorp

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Since the quality and standard of this manual are as much your responsibility as it is ours, we have

included a Publication Remarks section at the back of this manual. In the case of any errors that may exist within this manual or any positive suggestions that you may have, it would be appreciated if you will complete the Publication Remarks section, and either post it to:

Loadcell Systems (Pty.) Ltd
Technical Publications
P O Box 40371
Cleveland
2022

You may also *fax* a copy thereof to **+27 (11) 65-7889** or **E-Mail** it to ***route@iafrica.com***. This will allow us to present you with manuals that are of the same standard and quality as our range of products.

Consequential Damage

We will under no circumstances be held responsible for any claim which might arise from loss of production, or of any other nature, directly or indirectly, through the application of our equipment.

We will ensure that our equipment is used within its specific capabilities. Any application outside these specifications will be outside our responsibility.

Guarantee

Our equipment is guaranteed for a period of 12 (twelve) months from the date of the original invoice of such equipment. This guarantee covers faulty workmanship and failure during normal use only.

All repairs to the equipment will carry a guarantee period of 3 (three) months (on the repaired parts only) from the date of invoice of such repairs, provided these repairs fall outside the scope of the original guarantee period of twelve months.

All guarantees expire in the case of equipment been electrically damaged, mechanically mistreated, or should our equipment be used for any purpose other than specified.

The guarantee covers parts and labours only. Any transportation or travelling costs related to any repairs or guarantees will be charged for separately.

In the case of guarantee claims, it is the responsibility of the owner of such equipment to provide satisfactory proof of the date of invoice with relation to the guaranteed claim.

The Manuals

The complete description of your ***Route*** controller is contained within four manuals which includes:

* The Setup & Calibration Manual
* The Systems Manual
* The Applications Manual
* The Technical Manual

Each ***Route*** controller is supplied with an *Operational Manual*, a *Systems Manual* and an *Applications Manual*.

Since the Technical Manual contains critical information, it is optional and is only supplied on request after careful evaluation of the client.

1 Setup & Calibration Manual

The *Setup & Calibration Manual* is aimed at familiarizing yourself with all the setup functions, calibration facilities and basic features of your ***Route*** controller.

A thorough knowledge of the *Setup & Calibration Manual* is required to be able to fully understand the capabilities and limitations of your ***Route*** controller. Also, the *Setup & Calibration Manual* forms the basis for the other manuals. The contents of the *Setup & Calibration Manual* should be mastered before an attempt is made to study the other manuals.

The knowledge obtained from the *Setup & Calibration Manual* will enable:

* The production team to utilize the facilities properly which are provided by the ***Route*** controller.
* The project engineer to plan better use of existing ***Route*** controllers and to plan future extensions and implementations of ***Route*** controllers.

The topics covered within the *Setup & Calibration Manual* includes:

* Setup and Configuration.
* Calibration Functions.
* Basic Operational Functions.
* System Testing Functions.

The *Setup & Calibration Manual* is divided into sections. Each of these sections covers a specific function or group of functions which are related to each other. The sections contained within the *Setup & Calibration Manual* are listed in the main index in the front of this manual. A brief description of the nature of the functions covered within each of the sections is provided.

Throughout the *Setup & Calibration Manual* an attempt has been made to present each section with a top down approach. The advantage of this approach is that the reader will be able to tell whether any particular section is of interest to him, without a complete study of the section concerned.

2 Systems Manual

The *Systems Manual* is aimed at familiarizing yourself with the hardware aspects of your ***Route*** controller.

A thorough knowledge of the *Systems Manual* is required to be able to understand the hardware capabilities and limitations of your ***Route*** controller.

The knowledge obtained from the *Systems Manual* will enable:

* The production team to fully utilize the facilities provided for by the ***Route*** controller.
* The project engineer to plan better use of existing ***Route*** controllers and to plan future extensions and implementations of ***Route*** controllers.

The topics covered within the *Systems Manual* include:

* Hardware Configuration.
* Display Functions.
* Keyboard Functions.

The *Systems Manual* is divided into sections. Each of these sections covers a specific function or group of functions related to each other. The sections contained within the *Systems Manual*, are listed in the main index in front of the manual. A brief description of the nature of the functions covered within each of the sections is also provided.

Throughout the *Systems Manual*, an attempt has been made to present each section with a top down approach. The advantage of this approach is that the reader will be able to tell whether any particular section is of interest to him, without a complete study of the section concerned.

3 Applications Manual

The *Applications Manual* is aimed at familiarizing yourself with the operational and application aspects of your ***Route*** controller pertaining to a specific application or installation.

A thorough knowledge of the *Application Manual* is required to be able to understand the limitations and capabilities of the specific program of your ***Route*** controller.

The knowledge obtained from the *Application Manual* will enable:

* The production team to properly utilize the available facilities provided for by the specific application of the ***Route*** controller.
* The project engineer to plan better use of existing ***Route*** controllers and to plan future extensions and implementations of ***Route*** controllers.

The topics covered within the *Applications Manual* include:

* Operational functions pertaining to your specific application.
* Application functions.
* Programming and selection of targets/recipes.

The *Applications Manual* is divided into sections. Each section covers a specific function or group of functions related to each other. The sections contained within the *Application Manual*, are listed in the main index in the front of the manual. A brief description of the nature of the functions covered within each of the sections is also provided.

Throughout the *Applications Manual*, an attempt has been made to present each section with a top down approach. The advantage of this approach is that the reader will be able to tell whether any particular section is of interest to him, without a complete study of the section concerned.

4 Technical Manual

The Technical Manual covers the technical aspects of the ***Route*** controllers.

The Technical Manual assumes a technical background and is primarily aimed at maintenance personnel.

Information to be found in the Technical Manual includes:

* Printed Circuit Board Overlays
* Circuit Diagrams
* Component Lists

How to Use the Manuals

Each of the manuals has been provided with a dual index system which are:

* the main index which is found in the front of the manual. This index lists the different sections contained within the manual. A brief description of the nature of the functions or group of functions covered within a particular section is also provided.

* the section index which is provided for each section within the manual. The section index, (*which is placed in front of each of the sections concerned*) provides a detailed list (*together with page references*) of the topics covered within a particular section.

A specific topic or function within a manual may be found by:

* Referring to the main index and locate the section within which the function in question may be found, by studying the brief description of each of the sections listed.

* Turn to the sectional index of the section concerned, and locate the function or topic in question. Find the page reference (*which indicates the starting page*) of the function or topic of concern.

TABLE OF CONTENTS

1 Preface

This section contains a discussion of the first time setup and configurational functions of the *Route Series Controllers*. A detailed explanation of the functions that are common to all applications (*such as the Programming of Setpoints, the setting of the Real Time Clock, and the programming of the Serial Communications Ports*) is also included.

The functions required to complete the system setup are discussed in the preferred order in which they should be performed during the initial system setup. Even though it is not always necessary to follow the preferred order, in some cases the order in which these functions are performed is of importance. This is because some of the functions may have an influence on the parameters of other functions. Where this is the case, it will be pointed out during the discussion of the function concerned.

2 Introduction

The initial setup functions of the ***Route*** controller are summarized in *TABLE CNF-1*. Most of these functions will only be performed during the initial setup of the ***Route*** controller. Thereafter only selected functions need be performed when one or more of the parameters of the listed functions require a change due to changes in the definition of the system. Some of the listed functions also form part of the normal operating functions of the system.

SEQ	KEY SEQUENCE	ASSOCIATED FUNCTION	SECT	OTHER
1	SPAN SETP ENTER	Calibration Setpoints	CAL	NONE
2	TEST ZERO ENTER	ADC Zero Adjustment	CAL	4
3	TEST SPAN ENTER	ADC Gain Adjustment	CAL	4,5
4	ZERO ENTER	Zero Calibration	CAL	NONE
5	SPAN=40 ENTER	Span Calibration	CAL	1,4
6	TARGET SETP ENTER	System Configuration	TRG	1,7
7	TOTAL SETP ENTER	Totalising Setpoints	TOT	NONE
8	PRINT SETP ENTER	Printer Setpoints	REP	NONE
9	SETP ENTER	Application Setpoints	APL	1
10	DATE ENTER	Real Time Clock Set	CNF	NONE
11	BAUDR ENTER	Serial Port Programming	CNF	NONE
12	TARGET ENTER	Target Programming	TRG	1,6,7,9

SEQ	KEY SEQUENCE	ASSOCIATED FUNCTION	SECT	OTHER
13	TOTAL=<*password*>ENTER	Resetting of Totalisers	TOT	6,7,8
14	TOTAL TARGET ENTER	Setting Stock Levels	TOT	6,7,8
15	TEST 61 ENTER	Analog Input Assignment	TST	2,3,4,5
16	TEST 67 ENTER	Analog Output Assignment	TST	NONE
17	TEST 68 ENTER	Digital Output Assignment	TST	NONE
18	TEST 69 ENTER	Digital Input Assignment	TST	NONE

*TABLE CNF-1: Suggested order in which the setup functions of the **Route controller** should be completed.*

WHERE:

* **SEQ** indicates the suggested sequence in which the setup functions should be performed.
* **KEY SEQUENCE** is an example of the key sequence required to perform the listed function.
* **ASSOCIATED FUNCTION** defines the function which will be activated by the listed *KEY SEQUENCE*.
* **SECT** indicates the relevant section which should be consulted for the procedures concerning the listed functions.
* **OTHER** lists the sequence number of other functions that may be affected by the parameters of the associated function.

3 Setpoint Programming

This section only explains how to program the setpoints. The examples used in this explanation do not relate to any specific setpoint or setpoint value.

The available setpoints are grouped according to their related functions into the categories as indicated by *TABLE CNF-2*. For a complete list of the setpoints, please refer to the relevant sections within the manuals as indicated under *SECTION* in *TABLE CNF-2*. The setpoint lists defines the available setpoints for a specific application or function. The programming of the setpoints should be done with reference to these setpoint lists.

SETPOINT FUNCTION	KEY SEQUENCE	SECTION
Calibration Setpoints	SPAN SETP ENTER	CAL
Reporting & Printer Setpoints	PRINT SETP ENTER	REP
Totalising Setpoints	TOTAL SETP ENTER	TOT

SETPOINT FUNCTION	KEY SEQUENCE	SECTION
Application Setpoints	SETP ENTER	APL

TABLE CNF-2: A list of the four groups of setpoint functions into which the available setpoints have been divided. The section within which each of these groups of setpoints are discussed and the basic key sequence required to access these setpoints are also indicated.

EXAMPLE: Setpoint Programming

The programming of setpoints, is done with the aid of the *SETP* key. The *SETP* key is a dual function key, and is used both for:

* Display of setpoint parameters
* Change of setpoint parameters

These two functions are not separated from each other. Once a value is being displayed, it may be changed if required, by merely entering the new value. The setpoint programming functions are demonstrated by the example below. During the setpoint programming functions, the following keys will be active:

* **ENTER, CLEAR** ("←"), **NEXT** and **PREV** keys when no new value has been entered: To move on to the next or a previous setpoint.
* **ENTER, NEXT** and **PREV** keys after a value has been entered: To enter the new setpoint value.
* **CLEAR** ("←") and **CANCEL** while a value is being entered: To edit the entered setpoint value.
* **CANCEL** key when a new value is not being entered: To terminate the setpoint command sequence.

KEYBOARD ENTRIES	DISPLAY RESPONSE	ACTION REQUIRED
SPAN SETP ENTER	1:ZeroCn=<*value*>	'1:Zero C' is the setpoint iden-
NEXT (or ENTER)	1:SpanCn=<*value*>	tifier. <*value*> is the current va-
PREV (or ←)	1:ZeroCn=<*value*>	lue of the setpoint. Use the nu-
CANCEL	- Default Disp -	meric keys to change the value
SPAN SETP 4 ENTER	1:DiviSi=<*value*>	of the setpoint, followed by the
<*new value*> ENTER	1:DiviSi=<*new value*>	*ENTER* key. Use the *PREV* or
ENTER (or NEXT)	1:DampCn=<*value*>	*NEXT* key to select the previous
<*new value*> CANCEL	1:DampCn=<*old value*>	or next setpoint for display. Use

KEYBOARD ENTRIES	DISPLAY RESPONSE	ACTION REQUIRED
PREV (or ←)	1:DiviSi=<*value*>	the *CANCEL* key to terminate
CANCEL	- Default Disp -	the *SPAN SETP* function.

TABLE CNF-3: An example setpoint programming sequence.

4 Engineering Units

Measurand types have been predefined for the ***Route*** controller. For each measurand type, a set of five engineering units have been defined. These engineering units may be selected by setting the engineering unit setpoint to a value of between 0 and 4. This will select the appropriate engineering unit as indicated for the measurand of concern in *TABLE CNF-4* below.

The engineering units which will be available for selection depend on the measurand type which has been defined in the software.

VALUE / PARAM	0	1	2	3	4
Mass	Kton	ton	Kg	gm	mg
Volume	Gl	Ml	Kl	l	ml
Feed Rate	Kt/H	t/H	Kg/H	gm/H	mg/H
Flow/Hr	Gl/H	Ml/H	Kl/H	l/H	ml/H
Flow/min	Gl/m	Ml/m	Kl/m	l/m	ml/m
Flow/sec	Gl/s	Ml/s	Kl/s	l/s	ml/s
Belt Load	Kt/m	t/m	Kg/m	gm/m	mg/m
Belt Speed	m/s	m/m	mm/s	mm/m	mm/H
Time	Hrs	Mins	Secs	mSec	mSec
Torque	Nm				
Frequency	GHZ	MHZ	Khz	Hz	
Percentage	%				
Force	GN	MN	KN	N	mN
Angle	Deg				
Pressure	GPa	Mpa	KPa	Pa	mPa

VALUE / PARAM	0	1	2	3	4
Temperature	DegK	DegF	DegC		
Speed	Km/H				
Power	GW	MW	KW	W	mW

TABLE CNF-4: A list of the types of measurands defined for the ROUTE controllers indicating the engineering unit which will be selected for each setting of the Engineering Units setpoints.

5 System Calibration

The system calibration functions consist of the calibration of the analog I/O channels of the ***Route*** controller.

The analog input channels consist of both loadcell input channels (*which have been designed to specifically interface to loadcells*) and current/voltage input channels *(which have been designed to specifically interface to 0-5V, 0-10V and 4-20mA signals*).

The analog output channels consist only of current/voltage output channels. These channels have been designed to specifically drive 0-5V, 0-10V and 4-20mA interfaces.

Each of these analog channels has been assigned a channel number. The channel number is used during the calibration and setup functions of the system to identify the analog channel at which a requested function is aimed. As the number of analog channels depends on the application, the channel number assignment is defined in *TABLE APL-5* (*for analog input channels*) and *TABLE APL-6* (*for analog output channels*) in the *APL*-section of this manual.

The system calibration of the analog input channels consists of five basic functions which include:

* Calibration Setpoint Setup
* ADC Gain Adjustment (Loadcell channels only)
* ADC Zero Adjustment (Loadcell channels only)
* Zero Calibration
* Span Calibration

The system calibration of the analog output channels consists of two basic functions which are:

* Zero Calibration
* Span Calibration

The calibration functions should be performed for each of the analog channels concerned.

The specific parameters of the calibration which may influence other system configuration parameters are:

* Engineering Unit
* Decimal Relation

Both of these parameters are part of the calibration setpoints of the analog input channels concerned.

A complete description of the calibration functions of the ***Route*** controller will be found in the *CAL*-section of this manual.

6 System Configuration

The system configuration consists of defining the system variables such as the user passwords, product management, etc.

The system configuration is done with the aid of the *TARGET SETP ENTER* function. A complete discussion on the system setup functions will be found in the *TRG*-section of this manual.

7 Totaliser Configuration

The totaliser configuration defines the totalising requirements of the system such as:

* Mass Totalising Engineering Unit
* Mass Totalising Decimal Relation
* Time Totalising Engineering Unit
* Time Totalising Decimal Relation

The configuration of the system totalisers will only be allowed after the system configuration has been completed. A detailed explanation of the functions related to the system totalisers will be found in the *TOT*-section of this manual.

8 Printer Configuration

The printer configuration defines the requirements of the management reports and communication activities.

A detailed explanation of the functions related to the printer configuration will be found in the *REP*-section of this manual.

9 Application Configuration

The application configuration defined the operational requirements of the ***Route*** controller for a specific application.

A detailed explanation of the functions related to the application configuration will be found in the *APL*-section of this manual.

10 Target Setup

The target setup functions allow for the selection of a target mass, programming of recipes, etc.

A detailed explanation of the functions related to the target setup functions will be found in the *TRG*-section of this manual.

11 Real Time Clock Setting

The system has a 24-hour battery backed real time clock. The real time clock is used for:

* indication of the current date and time,
* generating the time related management reports,
* clearing of the time related totalisers,
* other functions which may be linked to the date and/or time.

The programming of the real time clock is done with the key sequence:

DATE ENTER

After entering this key sequence, the system will display the current date and time in the following format:

31Jan92 20:57:43

If any of the parameter of either the date or the time needs adjustment, this may be done by switching the front panel key-switch to the *CAL* mode, and then adjust the required parameters by using the following keys:

* **ENTER, DELETE** to move the cursor to the parameter that needs adjustment.
* **NEXT, PREV** to scroll the parameter until the correct value is displayed.
* **0 to 9** to directly enter the numeric values of the date or time. The months of Jan to Sep may also be selected with the numeric values of the corresponding month, ie. 1 to 9. 0 will select Oct. The remaining months may be selected by selecting the nearest month to the month required, and then scroll (using the *NEXT* and *PREV* keys) until the correct month is displayed.

NOTE: When the cursor reaches the open position between the date and the time, a number will appear. This number represents the current day of the week, where 1 to 7 normally represents Mon to Sun. Since the weekly report is generated on day one of the week, thus Monday, you may require to define this differently, ie. 1 to 7 for Wed to Tue, if the weekly report is required on Wednesday mornings.

The parameters that may be modified are:

* Date
* Month
* Year
* Day of week
* Hours
* Minutes
* Seconds

Both the units and tens of units of the Date, Year, Hours, Minutes and Seconds are independently adjustable.

12 Serial Port Programming

This section describes the programming of the two serial communication/printer ports.

The command format for the programming of the serial communication ports has been defined as:

BAUDRATE [<*port*>] ENTER

WHERE:

* <*port*> may be optionally specified as either 1, 2, 3 or 4 to select communications ports 1, 2, 3 or 4 respectively. If <*port*> has not been specified, port 1 will be assumed.

The parameters that may be altered during the serial communications port setup are:

* Baud Rate
* Word Length
* Number of stop bits
* Parity
* RS Type
* Response time
* Poll Time
* Hold Time

Each of the serial ports operates independently of the other. Therefor each port may be programmed to suit its own requirements. The available options for each of the parameters of the

port programming are predefined. These options match the options available for the serial communications controller in use.

During the programming of the serial communication channels, the following keys will be used:

* **NEXT, PREV** to select the required option of the displayed parameter.
* **ENTER** to accept the selected option and advance to the next programmable parameter.
* **DELETE** to revert back to the previously programmed parameter.
* **CANCEL** to cancel the programming function of the serial port.

NOTE: The procedure of the programming of the serial ports will be found at the end of this section.

12.1 Baud Rate

The baud rate defines the speed of transmission in bits per second.

The baud rates which are supported for both of the serial communication channels are:

* 50, 109.2, 134.58, 150, 300, 600, 1200, 1050, 1800, 2400, 3600, 4800, 7200, 9600, 19200, 38400

NOTE: Due to the opto-isolation of the serial communications, the maximum usable baud rate is limited to 9600 for RS232. This maximum baud rate value may deteriorate to as low as 4800 depending on the line condition and other external factors.

12.2 Word Length

The word length defines the number of bits which makes up the data part of the transmitted word.

The following word lengths are supported for all serial communication channels:

* 5, 6, 7 and 8

NOTE: The suggested word length for ASCII communications (*for example to a printer*) is normally 7 and for binary communications (*for example RTU MODBUS*) is 8.

12.3 Number of Stop Bits

The stop bits are markers transmitted at the end of each word to separate two successive words from each other. This is required for the ASYNC controller to synchronise on the start bit of each transmitted word.

The following number of stop bits is supported for all serial communication channels:

* 1 and 2

12.4 Parity

The parity checking provides for internal error detection in the ASYNC controller. If parity is enabled, a parity bit will be transmitted with each word.

The following parity formats are supported for both serial communication channels:

* None, Odd, Even, Mark, Space

NOTE: Since protocols such as MODBUS has its own error algorithm, namely CRC (*Cyclic Redundancy Check*), it is not required to further implement parity checking. Parity checking however does not influence the successful operation of such protocols.

12.5 RS Type

The RS Type allows for selecting the software driver required to satisfy the hardware in use.

The RS types that may be selected are:

* 232 (5 wire Full Duplex)
* 422 (4 wire Full Duplex)
* 422A (4 wire Full Duplex Multi-Drop)
* 485 (2 wire Half Duplex Multi-Drop)
* 422R (4 wire Full Duplex Multi-Drop External Hardware)
* 485R (2 wire Half Duplex Multi-Drop External Hardware)

12.6 Response Time

The Response Time allows for programming the delay time between:

* successive print lines, (*to allow for slow printers*)
* delay after a request before an attempt is made to respond to the request during communications,
* maximum time intervals between the transmission of two successive words *(the transmitter timeout*).

The Response Time is programmable in the range of 0.1 seconds through to 1.6 seconds. For printers the Response Time is normally set to 0.1 seconds.

12.6.1 Slow Printers

Normally printers provide either software (*X-On and X-Off*) or hardware (*RTS and CTS*) handshaking to control the data input to their print buffers.

When communicating with slow printers (*such as strip printers*) which have no handshaking facilities to control the communications, it is required to slow down the communications to prevent the overflow of the printer's input buffer.

This may be done by introducing a response delay. This will allow the printer to complete the printing of one line of information, before the next line of information is transmitted to the printer.

12.6.2 Transmission Time Out

During the communications process it may happen that the communication fails.

The response delay defines the maximum time interval between the transmission of two successive words.

Failing to meet this requirement will be considered as a communications error, upon which an attempt will be made to reactivate the communication.

12.6.3 Communications Response

During active communications, a blank time (*time of silence*) is required between two successive transmissions. This period of silence is used as a method of synchronising the communications.

The Response Time defines the time delay after receiving the last character of a request, before an attempt will be made to interpret the request and respond to it.

12.7 Poll Time

During communications, complete silence may occur on the communications channel. This may be due to no communication activities or temporarily communication failure.

The Poll Time defines the maximum silence time that may occur. After twice the defined silence period (*Poll Time*) has elapsed, a possible failure of the communication is assumed and an attempt will be made to recover the communication.

The Poll Times are programmable in a range of between 1 second and 6 minutes.

12.8 Hold Time

The Hold time is used for multi-drop communications only. This allows for the transmitter to be silent for the selected Hold time period before the transmitter will be switched off. When a hold time of 0.0 seconds is selected, the transmitter will be disabled as soon as the last character has been transmitted.

The Hold time is selectable between 0.0 seconds and 0.1 seconds in increments of 0.1 seconds.

12.9 PROCEDURE: Serial Port Programming

COMMAND: To program a serial port: Switch the front panel key-witch to the *CAL* position. Enter the command sequence required for the programming of the serial port.

BAUDRATE [<*port*>] ENTER

WHERE:

* <*port*> is the number of the serial port which is to be programmed. Enter a 1, 2, 3 or 4 to select between port 1, 2, 3 or port 4. If <*port*> is omitted, port 1 will be selected by default.
* [] indicate optional parameters.

STEP 1: Baud Rate.

DISPLAY: The system will respond by displaying the first parameter of the serial port programming, ie. baud rate, together with the baud rate currently selected.

BaudRate ? <*baudrate*>

WHERE:

* <***baudrate***> is the baud rate currently selected.

ACTION:

OPTION 1: If the displayed baud rate is correct, press the *ENTER* key.

OPTION 2: Select the correct baud rate by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected baud rate is correct.

OPTION 3: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 2: Word Length.

DISPLAY: The system will respond by displaying the word length parameter of the serial port programming together with the word length currently selected.

Word Len ? <*length*>

WHERE:

* <***length***> is the currently selected word length.

ACTION:

OPTION 1: If the displayed word length is correct, press the *ENTER* key.

OPTION 2: Select the correct word length by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected word length is correct.

OPTION 3: To return to STEP 1 (*programming of the baud rate*) press the *DELETE* key.

OPTION 4: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 3: Stop Bits.

DISPLAY: The system will respond by displaying the stop bits parameter of the serial port programming together with the number of stop bits currently selected.

Stop Bit ? <*stop*>

WHERE:
* <*stop*> is the number of stop bits currently selected.

ACTION:

OPTION 1: If the displayed number of stop bits is correct, press the *ENTER* key.

OPTION 2: Select the correct number of stop bits by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected number of stop bits is correct.

OPTION 3: To return to STEP 2 (*programming of the word length*) press the *DELETE* key.

OPTION 4: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 4: Parity Checking.

DISPLAY: The system will respond by displaying the parity checking parameter of the serial port programming together with the type of parity checking currently selected.

Parity ? <*parity*>

WHERE:
* <*parity*> is the type of parity checking currently selected.

ACTION:

OPTION 1: If the displayed parity checking is correct, press the *ENTER* key.

OPTION 2: Select the parity checking required by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected parity checking is correct.

OPTION 3: To return to STEP 3 (*programming of the number of stop bits*) press the *DELETE* key.

OPTION 4: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 5: RS Type.

DISPLAY: The system will respond by displaying the RS Type parameter of the serial port programming together with the RS Type currently selected.

RS Type ? <*type*>

WHERE:
* <*type*> is the RS Type currently selected.

ACTION:

OPTION 1: If the displayed RS Type is correct, press the *ENTER* key.

OPTION 2: Select the RS Type required by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected RS Type is correct.

OPTION 3: To return to STEP 4 (*programming of the parity checking*) press the *DELETE* key.

OPTION 4: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 6: Response Time.

DISPLAY: The system will respond by displaying the Response Time parameter of the serial port programming together with the Response Time currently selected.

Resp Time? <*time*>

WHERE:
* <*time*> is the Response Time currently selected.

ACTION:

OPTION 1: If the displayed Response Time is correct, press the *ENTER* key.

OPTION 2: Select the Response Time required by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected Response Time is correct.

OPTION 3: To return to STEP 5 (*programming of the RS Type*) press the *DELETE* key.

OPTION 4: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 7: Poll Time.

DISPLAY: The system will respond by displaying the Poll Time parameter of the serial port programming together with the Poll Time currently selected.

Poll Time? *<time>*

WHERE:
* *<time>* is the Poll Time currently selected.

ACTION:

OPTION 1: If the displayed Poll Time is correct, press the *ENTER* key.

OPTION 2: Select the Poll Time required by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected Poll Time is correct.

OPTION 3: To return to STEP 6 (*programming of the Response Time*) press the *DELETE* key.

OPTION 4: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 8: Hold Time.

DISPLAY: The system will respond by displaying the Hold Time parameter of the serial port programming together with the Hold Time currently selected.

Hold Time ? *<time>*

WHERE:
* *<time>* is the Hold Time currently selected.

ACTION:

OPTION 1: If the displayed Hold Time is correct, press the *ENTER* key.

OPTION 2: Select the Hold Time required by using the *NEXT* and *PREV* keys. Press the *ENTER* key when the selected Hold Time is correct.

OPTION 3: To return to step 7 (*programming of the Poll Time*), press the "<--" (*DELETE*) key.

OPTION 4: To cancel the programming of the serial port, press the *CANCEL* key.

STEP 9: Initialising the Port.

DISPLAY: Access to the systems calibration *RAM* (*Random Access Memory*) is requested to initialise the programmed port. This will only be done if the front panel key-switch is not in the *CAL* position at this stage.

Switch to Cal !

ACTION:

OPTION 1: Switch the front panel key-switch to the *CAL* position to allow the initialisation of the programmed port.

OPTION 2: Press the *CANCEL* key if the initialisation of the programmed port is not required.

NOTE: The newly programmed parameters will not take effect until such time as the port has been initialised.

After the programming and initialisation of the serial port has been completed, return the front panel key-switch to the *AUTO* position.

13 Preparation for Operation

After the completion of the system setup, as suggested in *TABLE CNF-1*, the system is to be prepared for operation. This preparation process consists of the following:

* Calibration
* Initialising the totalisers
* Initialising the stock levels
* Selecting/entering the required target

NOTE: Please consult the relevant sections under Calibration, Totalisers, System Setup (*as indicated in TABLE CNF-1*) in this manual for the procedures regarding these functions.

TABLE OF CONTENTS

1 Preface

This section contains a discussion of the principles of static weighing and calibration. A detailed explanation of each of the static calibration functions and procedures (*such as the calibration of the analog I/P and analog O/P channels*) of the ***Route*** *Series Controllers* is also included.

2 Introduction

The static calibration of the ***Route*** controller consists of the following functions:

* Analog I/P Calibration
* Analog O/P Calibration

Each of these calibration functions will now be discussed in full detail.

3 Analog I/P Calibration

3.1 Principles of Calibration

The calibration functions for the analog inputs are required to establish the relation between two forms of energy.

In the force measurement technology, force is converted to electrical energy by means of a strain gauge mounted on a piece of precision metal, commonly known as a loadcell. The deflection of the loadcell produces a change in voltage level which is proportional to the applied force.

Similarly, by using an appropriate transducer, many other forms of energy such as pressure, temperature, etc. may be converted to electrical energy which may be measured as a voltage or current source.

Since most of these sensing devices have a linear response (the relation between the two forms of energy will plot a straight line), we need only to determine two points of the vector to be able to calculate all remaining points of the vector which are:

* a voltage/current signal produced when minimum force is applied (*measured by the Zero Calibration function*).
* a voltage/current signal when a known force is applied (*measured by the Span Calibration function*).

In some instances the relation between the two forms of energy (*applied force and resultant voltage/current*) is nonlinear in which case linearization is required. With linearization more than one point of the vector is recorded, allowing the system to follow and compensate for the non linearity. The output therefor will produce what appears to be a linear representation of the measurand. The number of points required to effectively interpret the nonlinear characteristic of

the sensing device depends on the extend of the non linearity.

3.2 Calibration Setup Functions

The analog input channels of the ***Route*** controller consist of two analog input types which are:

* Loadcell I/P's which have been specifically designed for interfacing with strain-gage type loadcells (*ie., 10 Vdc excitation with input range of ±25 mV*).
* Current/voltage I/P's which have been specifically designed for interfacing with transducers producing an output of either 0-5/10 Vdc or 0/4-10/20 mA.

The calibration functions for both these types of analog inputs are exactly the same and consist of:

* The configuration of the Calibration Setpoints (*SPAN SETP's*).
* ADC (*Analog to Digital Converter*) Zero Adjustment (*Loadcell channels only*).
* ADC Gain Adjustment (*Loadcell channels only*).
* Zero Calibration.
* Span Calibration.
* Linearization (*Only if required*).

For all calibration functions, the analog input that needs to be calibrated/configured has to be identified. For this purpose, each analog input channel has been assigned a unique channel number.

NOTE: The channel numbers assigned are defined under *Analog Inputs* in the *APL-section* of *Applications* manual.

The assigned channel number has to be specified during the entry of the command sequence calling for a calibration or configuration of the analog input. When the channel number is omitted, then channel #1 (*ie. Loadcell #1*) will be assumed.

3.3 Calibration Setpoints

The calibration setpoints define the calibration parameters and functions of the analog input channels. An identical set of calibration setpoints exists for each of the analog input channels.

The format of the command sequence required to access the calibration setpoints have been defined as:

SPAN [<*channel*>] SETP [<*reference*>] ENTER

WHERE:

* <***channel***> identifies the analog channel *(as defined under Analog Inputs in the APL-section of the Applications manual)* of interest

* *<reference>* specifies the setpoint's reference number of interest.
* [] indicate optional parameters. When the parameters within the square brackets are omitted, the default values are assumed. For both the *<channel>* and *<reference>* values, the default is 1.

A typical list of calibration setpoints which have been defined for each of the analog input channels is given in *TABLE CAL-1* above using channel #1 as an example. After all the calibration functions have been performed, the actual values of these calibration setpoints should be recorded in the space provided for later reference.

NOTE: Since the calibration setpoints of all the analog I/P channels are identical, only one list of calibration setpoints has been included (that of channel #1 as indicated by the "1:" appearing in front of all the setpoint ID's being displayed). A similar list for each of the defined analog I/P channels has been included in the COM-section of this manual.

3.3.1 TABLE: Calibration Setpoints

3.4 TABLE: SPAN 1 SETP ENTER

NO	DISPLAY	UNIT/RANGE	VALUE	DESCRIPTION
1	1:ZeroCn	Counts	*	A/D Zero Counts
2	1:SpanCn	Counts	*	A/D Span Counts
3	1:SpanMa	Mass Units	*	Calibration Mass
4	1:MassRa	Mass Units		Display Range
5	1:DiviSi	Mass Units	1,2,5,10	Display Divisions
6	1:DampCn	1..31		Damping Constant
7	1:TrckRn	Mass Units		Tracking Mass Limit
8	1:TrckTi	0.1 sec		Tracking Duration
9	1:ZeroRn	Mass Units		Zero Calibrate Limit
10	1:StabRn	Mass Units		Stability Mass Range
11	1:StabTi	0.1 sec		Stability Duration
12	1:Eng Un	0..4		Engineering Units
13	1:Eng De	0..3		Decimal Precision
14	1:ADC Ze	0..255	**	A/D Converter Zero
15	1:ADC Ga	0..255	**	A/D Converter Gain

* These values are recorded by the zero and span calibration functions (*see Zero Calibration and Span Calibration later in this section*) and should not be altered manually as this will upset the calibration of the analog I/P channel.

** These values are recorded by the zero and gain adjustment functions (*see ADC Zero and Gain Adjustment later in this section*) and should not be altered manually as this will upset the calibration of the analog I/P channel.

TABLE CAL-1: A list of the calibration setpoints which have been defined for channel #1 indicating the reference number, displayed ID, unit or range and a brief definition.

3.4.1 Calibration Setpoint Definitions

3.4.1.1 Analog Span

To be able to do scaling on the analog values provided by the A/D converters, two *Masses* vs. *Counts* points are required. The first of these points (*called the base or zero reference point*) provides the *Zero* vs. *Counts* reference point. The second point provides the *Test Mass* vs. *Counts* point. As noticed, three unknown values need to be resolved which are:

* Counts for Mass=0 (A/D Zero Counts)
* Counts for Test Mass (A/D Span Counts)
* Test Mass (Span Mass)

With the aid of these values we can define the complete vector for Mass vs. Counts. Since the vector is linear (*it's linearity being determined by the linearity of the transducer in use*), we are able to calculate the equivalent mass for any other A/D value by applying the formula that defines this vector. The formula for this vector is defined as:

$$Value_{act} = \frac{Value_{cal}}{ADC_{cal}} * (ADC_{act} - ADC_{zero})$$

WHERE:

* **$Value_{act}$** is the equivalent of the measurand
* **$Value_{cal}$** is the reference measurand during calibration.
* **ADC_{cal}** is the reference A/D converter reading during calibration.
* **ADC_{act}** is the current A/D converter reading.
* **ADC_{zero}** is the equivalent A/D converter reading when the measurand is zero.

Assuming a linear transducer, this formula is true even beyond the specified span mass and below the zero calibrated point (*ie. zero counts*), since these parameters only define the direction and slope of the vector, and not the limits. The limits are defined by the operating range of the transducers in use. When the A/D value drops below the recorded *Zero Counts* (*calibration zero point*) only the direction of the vector will change. This is indicated by the negative mass value obtained from the formula.

3.4.1.1.1 (*ZeroCnts*) A/D Zero Counts

The A/D *Zero Counts* setpoint defines the value obtained from the A/D converter (*referred to as A/D Counts*) when the scale is empty (*ie. holds an equivalent zero mass*).

The value of the *Zero Counts* setpoint is recorded during the zero calibration procedure and should not be manually altered, since this will change the zero calibration of the system.

3.4.1.1.2 (*SpanCnts*) A/D Span Counts

The *A/D Span Counts* setpoint defines the value of the A/D converter (*referred to as A/D Counts*) when a known (*ie. Calibration Mass*) is suspended on the scale.

The value of the *Span Counts* setpoint is recorded during the span calibration procedure and should not be manually altered, since this will change the span calibration of the system.

3.4.1.1.3 (*SpanMass*) Calibration Mass

The *Calibration Mass* setpoint defines the value of the mass that was used during the span calibration (*ie. for which the equivalent A/D Span Counts was recorded*).

The value of the *Calibration Mass* setpoint is recorded during the span calibration procedure and should not be manually altered, since this will change the span calibration of the system.

3.4.1.2 (*MassRnge*) Display Range

The *Mass Range* setpoint selects the maximum display range of the measurand (*ex. Mass*).

If the measurand exceeds the maximum value specified, then:

* The value is replaced by the message "*Over Range*".
* The "*LC Over Range*" alarm is activated.

The *LC Over Range* detection function is active only when the specified *Mass Range* value is in excess of the *Calibration Mass* setpoint value (*ie. the mass with which the system was calibrated*). Thus, to disable the *LC Over Range* detection function, the *Mass Range setpoint* value must be set to any value which is less than the *Span Mass* setpoint value (*ie. normally set to zero*).

3.4.1.3 (*DiviSize*) Division Size

The *Division Size* setpoint defines the smallest increment with which the measurand may change.

EXAMPLE: If a division size of 2 is selected, then the measurand will always change with increments of 2, ie. 0.2 Kg, 0.4 Kg, ... etc. or 2 Kg, 4 Kg, ... etc.

A *Division Size* of either 1, 2, 5 or 10 may be selected. If a Division Size of any other value is selected, then a Division Size of 1 will take effect.

The *Division Size* is normally set to keep the measurand within the accuracy class of the transducer in use. For loadcells this is typically 1 in 3000 thus:

$$\frac{Capacity_{max}}{DiviSize} \leq 3000$$

WHERE:

* **$Capacity_{max}$** is the maximum combined capacity of the load transducer arrangement.

EXAMPLE: For a loadcell configuration with maximum capacity of 5 tonnes, the division size should be set to 2 which is determined as follows:

$$\frac{5000}{3000} = 1.67$$

which relates to a division size of 2.

3.4.1.4 *(DampCnts)* Damping Constant

Damping is available on the analog I/P channels to stabilize the measurand. With damping, the value of the displayed measurand is the average of a selected number of measurements. The amount of damping required is determined by the stability required for the displayed measurand and specified by the *Damping Constant* setpoint.

EXAMPLE: If a damping constant of 6 is specified, then the value of the displayed measurand will be the average of the last six measurements from the analog input channel.

The damping constant may be set anywhere within its defined lower and upper limits (*which are 1 and 31 respectively*), depending on the amount of damping required. If the damping constant is set outside these limits is selected, a damping constant of 1 will take effect. Normally the damping constant is set to a value of between 5 and 20.

3.4.1.5 Zero Tracking

Zero Tracking is the action by which an automatic zero function is performed when the measurand is within a specified limit during a specified time.

As can be seen from this definition, two parameters are required to define the operation of zero tracking function which are as follows:

* The *Zero Tracking Range* which defines the range (*referenced to the calibrated zero point*) within which zero tracking may be performed.
* The *Zero Tracking Time* which defines the time for which the measurand should be stable

(*see Stability under Calibration setpoints later in this section*) within the *Zero Tracking Range* before *Zero Tracking* will be performed.

NOTE: The *Zero Tracking Timer* is reset to 0 each time the measurand either is zero or exceeds the specified *Zero Tracking Range*. *Zero Tracking* is performed each time the *Zero Tracking Timer* reaches the specified *Zero Tracking Time*, after which it will be reset to 0.

Zero tracking will not be performed if either or both of the defining parameters of zero tracking are set to zero or if the accumulative deviation of the zero tracking function will exceed the *Zero Tracking Range* value.

The zero tracking function is very similar to the zero calibration function, accept that it will be performed automatically whenever it's defining parameters are satisfied.

3.4.1.5.1 (*TrckRnge*) Zero Tracking Range

The *Zero Tracking Range* setpoint defines the range within which the zero tracking may be performed as well as the maximum accumulative deviation of the measurand from the calibrated zero point.

If the zero tracking function is not required the value of the *Zero Tracking Range* setpoint should be set to 0.

3.4.1.5.2 (*TrckTime*) Zero Tracking Time

The *Zero Tracking Time* setpoint defines the time during which the measurand must be:

* stable (*see Stability under Calibration Setpoints later in this section*), and
* within the *Zero Tracking Range*

in order for the zero tracking function to be activated.

If the zero tracking function is not required, the value of the *Zero Tracking Time* setpoint should be set to 0.

3.4.1.6 (*ZeroRnge*) Zero Calibration Limit

The *Zero Calibration Limit* setpoint defines:

* the range within which a non-*CAL Zero Calibration* (*ie. Operational Zero Calibration*) may be performed, as well as
* the maximum deviation (*from the calibrated zero point*) which is allowed for the non-*CAL* zero calibration value.

This function allows a zero calibration to be performed with a closed *CAL-switch* within the specified limits.

NOTE: If the zero calibration required is not within the range of the *Zero Calibration Limit*, the zero calibration will not be allowed unless the system is switched to the *CAL-mode*. If the zero calibration cannot be performed with a closed *CAL-switch*, the system displays the "*Zero Range !*" warning message.

3.4.1.7 Analog Input Stability & Flow Detection

Stability is obtained when the rate of change (*ie. the incremental change during a predefined time span*) of a measurand does no exceed a set maximum value. As can be seen from this definition, two parameters are required to define the maximum rate of change for the stability function which are the following:

* The *Stability Range* which defines the maximum incremental value by which the measurand may change during a specified time span.
* The *Stability Time* which defines the time duration for which the measurand should be monitored.

From a flow point of view, we may say that positive flow is obtained when the rate of change (*ie. the incremental change during a predefined time span*) of a measurand exceeds a set minimum value. In this case, the defining parameters are interpreted as follows:

* The *Stability Range* which defines the minimum incremental value by which the measurand should change during a specified time span.
* The *Stability Time* which defines the time duration for which the measurand should be monitored.

Since the defining parameters of stability and flow are equivalent (*and stability on the broader sense of the word can be defined as no flow and vice versa*), the stability parameters are also used to detect positive flow.

3.4.1.7.1 (*StabMass*) Stability Mass Range

The *Stability Range* setpoint defines the limits of the incremental value of the measurand for the detection of stability and flow as follows:

* **Stability** - The maximum incremental value by which the measurand may change during a specified time span for the measurand to be considered stable.
* **Flow** - The minimum incremental value by which the measurand should change during a specified time span for a positive to be registered.

If neither the stability nor the flow detection function is required, the value of the *Stability Range* setpoint should be set to 0.

3.4.1.7.2 (*StabTime*) Stability Time

The *Stability Time* setpoint defines the time span for which the measurand should be monitored for the detection of stability and flow as follows:

* **Stability** - The time span for which the incremental value of measurand should not exceed the specified range (*Stability Range*) for the measurand to be considered stable.
* **Flow** - The time span for which the incremental value of the measurand must exceed the specified range (*Stability Range*) for a positive flow to be registered.

If neither the stability nor the flow detection function is required, then the value of the *Stability Time* setpoint should be set to 0.

3.4.1.8 (*Eng Unit*) Engineering Units

The *Engineering Units* setpoint selects the engineering units in which the measurand of the related analog input channel is measured.

The *Engineering Units* setpoint may be set to a value of between 0 and 4, which will be interpreted as indicated in *TABLE CNF-4* (*see Engineering Units in the CNF-section earlier in this manual*). If an Engineering Unit outside these limits is specified, then an engineering unit value of 0 will be assumed.

3.4.1.9 (*Eng Deci*) Decimal Position

The *Decimal Position* setpoint selects the resolution to which the measurand of the related analog input channel is measured.

The decimal position may be selected for a value of between 0 and 3, being the number of digits behind the decimal comma. If a decimal position outside these limits is specified then a decimal position of 0 will be assumed.

3.4.1.10 A/D Converter Control

The *A/D Converter Control* setpoints define the parameters for the electronic zero and gain adjustment of the A/D converter (*only available for the loadcell input channels*).

3.4.1.10.1 (*ADC Zero*) A/D Converter Zero

The *A/D Converter Zero* setpoint is used to adjust the electronic zero of the A/D converter. The purpose of the electronic zero adjustment is to cancel out any dead mass of the weighing mechanics before gain adjustment is applied thereby eliminating the amplification of the dead mass.

The range of the *A/D Converter Zero* setpoint is from 0 to 255 which represents an equivalent

zero adjustment of -1.2 V to +1.2 V respectively at the input of the A/D converter and -12 mV to +12 mV respectively at the loadcell input. The mid-range position of this setpoint is 128 which cancels all zero offsets.

The *A/D Converter Zero* setpoint is protected by a check sum which is part of the setpoint value. The setpoint value to be entered to obtain a specified zero offset adjustment can be calculated as follows:

$$ADC_{zero} = 128 + (mV_{offs} * \frac{128}{12})$$

WHERE:

* ADC_{zero} is the value required for the ADC zero setting to produce the required mV_{offs}.

$$ADC_{zero_{setpt}} = ((256 - ADC_{zero}) * 256) + ADC_{zero}$$

EXAMPLE: To set the *A/D Converter Zero* for no zero offset adjustment (ie., 128 which is also the default setting), the value to be entered as the *A/D Converter Zero* setpoint may be calculated as follows:

$$ADC_{zero} = 128 + (0mV_{offs} * \frac{128}{12}) = 128$$

$$ADC_{zero_{setpt}} = ((256 - 128) * 256) + 128 = 32896$$

NOTE: The A/D Converter Zero offset adjustment is supported by the *TEST ZERO* function (*see ADC Zero Adjustment within the CAL-section of this manual*).

3.4.1.10.2 *(ADC Gain)* A/D Converter Gain

The *A/D Converter Gain* setpoint is used to adjust the electronic gain of the A/D Converter. The purpose of the A/D Converter Gain adjustment is to increase the resolution of the measurand in applications where only part of the full span range of the transducer is utilized.

The range of the *A/D Converter Gain* setpoint is from 0 to 255, which represents an equivalent full scale input of 0.01 V to 2.55 V respectively at the input of the A/D converter or 0.1 mV to 25.5 mV respectively at the loadcell input of the system, which results in an adjustment of the sensitivity of the A/D converter from 0.005 mV to 1.275 mV.

The *A/D Converter Gain* setpoint is protected by a check sum which is part of the setpoint value. The setpoint value to be entered to obtain the required A/D converter gain adjustment can be calculated as follows:

$$ADC_{gain}=(255*\frac{100}{\%_{signal}})$$

WHERE:

* $\mathbf{ADC_{gain}}$ is the gain setting required to amplify the $\%_{signal}$ to full strength.

$$ADC_{gain_{setpt}}=((256-ADC_{gain})*256)+ADC_{gain}$$

EXAMPLE: To set the A/D Converter Gain for maximum input level (*ie. 100% input which is also the default setting*), the value to be entered as the *A/D Converter Gain* setpoint can be calculated as follows:

$$ADC_{gain}=(255*\frac{100}{100})=255$$

$$ADC_{gain_{setpt}}=((256-255)*256)+255=511$$

NOTE: The A/D converter gain adjustment is supported by the *TEST SPAN* function (*see ADC Gain Adjustment in the CAL-section of this manual*).

3.5 Calibration Variables

The Calibration Variables are registers within which the system records the results obtained from the calculations when converting the A/D Converter values to the equivalent of a measurand. An identical set of Calibration Variables exists for each of the analog input channels. These values are useful during the evaluation of the operation of the analog input channels.

The format of the command sequence to access the Calibration Variables, is given as:

TEST 1[<*channel*>][<*reference*>] ENTER

WHERE:

* <***channel***> is the number of the analog input channel (*as defined under Analog Inputs in the APL-section of this manual*) of interest.
* <***reference***> is the number of calibration variable (*as defined in TABLE CAL-2*) of interest.
* [] indicate optional parameters. If any of these parameters are omitted during command entry, the default value of 1 is assumed.

A typical list of the calibration variables which have been defined for each of the analog input channels is given in *TABLE CAL-2* below using channel #1 as an example.

NOTE: Since the calibration variables of all the analog I/P channels are identical, only one list

of calibration variables has been included (that of channel #1 as indicated by the "1:" appearing in front of all the variable ID's being displayed).

3.5.1 TABLE: Calibration Variables

NO	DISPLAY	UNIT/RANGE	DESCRIPTION
1	1:Raw Va	Counts	Raw A/D converter counts
2	1:DampVa	Counts	Damped A/D converter counts
3	1:ZeroVa	Counts	Zeroed A/D converter counts
4	1:LastSp	Mass Units	Span mass on last A/D conversion
5	1:SpanMa	Mass Units	Converted mass value
6	1:TareMa	Mass Units	Last stored tare mass
7	1:TrckZe	Mass Units	The current zero tracked mass
8	1:TrckTi	0.1 sec	Auto zero tracking timer
9	1:ZeroMa	Mass Units	Operator zero mass
10	1:LastFl	Mass Units	The last measured flow rate
11	1:FlowRa	Mass Units	The measured flow rate
12	1:StabTi	0.1 sec	Stability Timer
13	1:LastCn	2 mSec	Last conversion 2 mSec timing pulses count
14	1:FlowCn	2 mSec	This conversion 2 mSec timing pulses count
15	1:Stab/M	256, 1	Stability/Motion flags
16	1:OverRn	0, 1	Overrange Flag
17	1:DampCn	0..31	Damping Pointer
18	1:DampTa	Mass Units	First value of damping table

TABLE CAL-2: A list of the calibration variables which have been defined for channel #1 indicating the reference number, displayed ID, unit or range and a brief definition.

3.5.2 Variable Definitions

3.5.2.1 *(Raw Valu)* ADC Reading

The *Raw Value* is the A/D converter reading before any processing is performed on it.

3.5.2.2 (*DampValu*) Damped ADC Reading

The Damp Value is the *Damped A/D converter Reading*. This value is calculated as the average of the number of readings as specified by the *Damping Constant* setpoint (*see Damping Constant under Calibration Setpoints earlier in this section*).

3.5.2.3 (*ZeroValu*) Zeroed ADC Reading

The *Zeroed ADC Value* is the A/D converter reading after subtraction of the calibrated *ADC Zero Counts* setpoint (*see ADC Zero Counts under Calibration Setpoints earlier in this section*).

3.5.2.4 (*LastSpan*) Last Converted Value

The *Last Converted Value* is the A/D converter reading which have been converted to represent the equivalent of the measurand on the previous conversion cycle. This value, together with the *Spanned Value*, is used for stability and flow detection.

3.5.2.5 (*SpanMass*) Converted Value

The *Converted Value* is the A/D converter reading after it has been converted to represent the equivalent of the measurand. This value is calculated as:

$$Value_{act} = (ADC_{act} - ADC_{zero}) * \frac{Value_{cal}}{ADC_{cal}}$$

WHERE:

* ADC_{act} is the current A/D converter reading.
* ADC_{zero} is the A/D converter reading when the measurand is zero (*see ADC Zero Counts under Calibration Setpoints earlier in this section*).
* ADC_{cal} is the reference A/D converter reading during the span calibration (*see ADC Span Counts under Calibration Setpoints earlier in this section*).
* $Value_{cal}$ is the reference value of the measurand during the span calibration (*see Span Mass under Calibration Setpoints earlier in this section*).

3.5.2.6 (*TareMass*) Tare Mass Value

The *Tare Mass Value* is the value of the measurand that was recorded during the last tare function. This value is recorded only when the tare function is performed.

3.5.2.7 (*TrckZero*) Zero Tracking Value

The *Zero Tracking Value* is the zero tracked value of the measurand. This value will be continuously updated when the measurand value complies with the requirements of the zero tracking function (*see Zero Tracking under Calibration Setpoints earlier in this section*).

3.5.2.8 (*TrckTimr*) Zero Tracking Timer

The *Zero Track Timer* is the timer with which the system times the progress of the zero tracking function. This timer will be reset to zero whenever the measurand does not conform to the requirements of zero tracking (*see Zero Tracking under Calibration Setpoints earlier in this section*).

3.5.2.9 (*ZeroMass*) Zero Mass Value

The *Zero Mass Value* is the value of the measurand that was recorded during the last non-*CAL* zero calibration function (ie. operators zero function). This value is only recorded when the non-*CAL* zero function is performed (*see Zero Range under Calibration Setpoint earlier in this section*).

3.5.2.10 (*LastFlow*) Last Incremental Value

The *Last Incremental Value* is the incremental value of the measurand during the previous conversion cycle.

3.5.2.11 (*FlowRate*) Incremental Value

The *Incremental Value* is the incremental value of the measurand for the current conversion cycle. This value is calculated as the difference between the equivalent measurand of the current and the previous conversion cycles.

3.5.2.12 (*StabTimr*) Stability Timer

The *Stability Timer* is the timer with which the performance of the stability requirement is monitored. This timer is reset to zero when the value of the measurand does not conform to the requirements of stability (*see Stability under Calibration Setpoints earlier in this section*).

3.5.2.13 (*LastCntr*) Last Conversion Time

The *Last Conversion Time* is used to record the interval time of the previous conversion cycle between two conversions in multiples of 2 mSec.

3.5.2.14 (*FlowCntr*) Conversion Time

The *Conversion Time* is used to record the interval time between two conversions in multiples of 2 mSec.

3.5.2.15 (*Stab/Mot*) Stability & Motion Flags

The *Stability and Motion flags* are flags which are set when either stability or motion is detected. A value of 256 indicates stability and a value of 1 indicates motion.

3.5.2.16 (*OverRnge*) Over Range Flag

The *Over Range Flag* is a flag which is set when the value of the measurand is in excess of the specified *Mass Range* setpoint.

3.5.2.17 (*DampCntr*) Damping Counter

The *Damping Counter* is a counter (*ranging from 1 to a maximum value as determined by the Damping Constant setpoint*) which indicates the current position in the damping table to which the measured value will be written.

3.5.2.18 (*DampTabl*) Damping Table

The *Damp Table* is the first value of the damping table which is used for the calculation of the damped measurand. This value is updated once during the each damping cycle. The duration of the damping cycle is a function of the conversion rate and the damping constant setpoint.

3.6 ADC Zero Adjustment

The ADC zero adjustment electronically adjusts the zero offset of the A/D converter. The purpose of this is to electronically cancel out any zero offsets in the incoming signal (*ex. due to the dead mass of the weighing mechanics*). This is necessary to prevent unnecessary amplification of inherent zero offset of the measurand when amplification of the incoming signal is required (*see ADC Gain Adjustment later in this section*).

This *ADC Zero Adjustment* function calculates and updates the value of the *ADC Zero* setpoint (*see ADC Zero setpoint under Calibration Setpoints earlier in this section*).

The command sequence for the *ADC Zero Adjustment* function is defined as:

TEST ZERO [[<*channel*>] = <*offset*>] ENTER

WHERE:

* <***channel***> is the channel number of the analog input (*as defined under Analog Inputs in the APL-section of this manual*) for which ADC zero adjustment is required. This parameter is optional and only need be specified for channels #2 onwards. If <*channel*> is omitted, channel #1 will be assumed.
* <***offset***> is the optional negative offset (*between 0 and 10,000 ADC Counts*) required for the *ADC Zero*. This may be used to increase the range within which the A/D converter will operate up to an absolute maximum of 1:30,000. If this parameter is omitted, an offset of zero will be assumed.
* [] indicate optional parameters.

PROCEDURE: ADC Zero Adjustment

The procedure (*which is independent of the type of measurand*) for the ADC Zero Adjustment function (*assuming a scale is to be calibrated*) is as follows:

* Ensure that the scale is empty.
* Select the scale mass parameter (normally "SM= 00,0 Kg RD") for display on the top display line.
* Switch the front panel key-switch to the *CAL* (*see Front Panel Key-switch in the PAN-section of the Systems Manual*) position.
* Press TEST ZERO <*channel*> ENTER where <*channel*> is the analog input's channel number (*see Analog Inputs in the APL-section of this manual*) for which the ADC Zero Adjustment is required.
* The bottom display line should indicate "ADC Zero= <*value*>". The <*value*> will be changed until the A/D converter input is as close to zero (*as no adjustment value has been specified*) as possible.
* After the function has been completed, return the front panel key-switch to the **AUTO** position.

This concludes the ADC Zero Adjustment function.

NOTE: The ADC Zero Adjustment may be set to the default value by setting the ADC Zero setpoint to 0. This value will then be replaced by the default value.

The zero calibration of the analog input is always affected by the ADC zero adjustment and should therefor be done only after the successful completion of the ADC zero adjustment.

3.7 ADC Gain Adjustment

The ADC Gain Adjustment electronically adjusts the gain of the A/D converter. The purpose of this gain adjustment is to electronically change the range of the A/D converter to optimize the measuring range of the A/D converter to match the available range of the measurand in order to maximize the resolution with which the measurand is measured.

This ADC gain adjustment function calculates and updates the value of the *ADC Gain* setpoint (*see ADC Gain setpoint under Calibration Setpoints earlier in this section*).

The command sequence of the ADC Gain Adjustment function is defined as:

TEST SPAN [[<*channel*>] = <*signal*>] ENTER

WHERE:

* <*channel*> is the channel number of the analog input (*as defined under Analog Inputs in the APL-section of this manual*) for which the ADC Gain Adjustment is required. The

<*channel*> parameter is optional and only need be specified for channels #2 onwards. If <*channel*> is omitted, channel #1 will be assumed.

* <***signal***> is the optional signal strength percentage for which a full scale range is required from the A/D converter. This may be used to increase the resolution of the A/D converter up to a maximum of 1:30,000. If this parameter is not specified, a signal strength of 100% of full scale is assumed.
* [] indicates an optional parameter.

The percentage signal strength, which can be used in the ADC Gain Adjustment, is a function of:

* The percentage inherent zero offset in the measurand (*ie. Dead weight in scales*).
* The percentage of the range of the transducer to be used.
* The percentage losses in the signal and excitation due to isolators etc.

The signal strength may be calculated as:

$$\%_{signal} = \%_{range} - \%_{losses}$$

The % inherent zero offset may be calculated as:

$$\%_{zero} = \frac{Zero}{Range_{max}} * 100\%$$

The % usable range may be calculated as:

$$\%_{range} = \frac{Range_{use}}{Range_{max}} * 100\%$$

The % losses may be calculated as:

$$\%_{losses} = (1 - \frac{Signal_O}{Signal_I}) * 100\%$$

PROCEDURE: ADC Gain Adjustment

The procedure (*which is independent of the type of measurand*) for the ADC Gain Adjustment function (*assuming a scale is to be calibrated*), is as follows:

* Ensure that the scale is empty.
* Select the scale mass parameter (normally "SM= 00,0 Kg RD") for display on the top display line.
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).

* Press TEST SPAN <*channel*> = <*signal*> ENTER, with the channel corresponding with the channel number of the analog input channel (*see Analog Inputs in the APL-section of the Applications manual*) for which the ADC Gain adjustment is to be performed.
* Return the front panel key-switch to the *AUTO* position.

This concludes the ADC Gain Adjustment function.

NOTE: The span and zero calibration of the analog inputs are always affected by the ADC Gain Adjustment. Both the zero and span calibrations should therefor be rechecked and corrected after the ADC Gain adjustment has been completed.

The ADC Gain may be set to the default value by setting the *ADC Gain* setpoint (*see Calibration Setpoints earlier in this section*) of the respective channel to 0. This value will then be changed to the default value.

3.8 Zero Calibration

The Zero Calibration function records the output signal of a transducer (*such as a loadcell*) which represents an equivalent measurand value of zero. The output signal (*which is measured as A/D counts*) is recorded in the *A/D Zero Counts* setpoint (*see ADC Zero Counts under Calibration Setpoints earlier in this section*) of the respective channel.

The command sequence for the zero calibration function is defined as:

ZERO [<*channel*>] [=<*value*>] ENTER

WHERE:

* <***channel***> is the analog input's channel number (*as defined under Analog Inputs in the APL-section of the Applications Manual*) for which the zero calibration is to be performed. This <*channel*> parameter is optional and only need be specified for channels 2 onwards. If <*channel*> is omitted, channel #1 will be assumed.
* <***value***> indicates the optional zero value of the measurand (*which is only required when correcting for a known zero measurand value after the initial zero calibration*). If <*value*> is omitted, a value of 0 will be assumed (*ie. normal zero calibrations*).
* [] indicate optional parameters.

PROCEDURE: Zero Calibration

The procedure (*which is independent of the type of measurand*) for zero calibration (*assuming a scale is to be calibrated*) is as follows:

* Ensure that the scale is empty.
* Select the scale mass parameter (*normally "SM= 00,0 Kg RD"*) for display on the top display line.
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the*

PAN-section of the Systems Manual).

* Press ZERO <*channel*> ENTER where <*channel*> corresponds to the analog input's channel number (*see Analog Inputs in the APL-section of the Applications Manual*) for which the zero calibration is to be performed.
* Return the front panel key-switch to the *AUTO* position.
* Ensure that the scale mass parameter on the top display line indicates a zero mass (*see NOTE below*).

This concludes the zero calibration function.

NOTE: After the zero calibration function has been completed, always ensure that the scale parameter on the top display line indicates a zero mass. If this is not the case (*assuming the zero calibration was performed properly*), do the span calibration and then redo the zero calibration.

3.9 Span Calibration

The span calibration function records the output signal of the transducer (*such as a loadcell*) which represents a known measurand. The output signal (*which is measured as A/D counts*) is recorded in the *A/D Span Counts* setpoint (*see ADC Span Counts under Calibration Setpoints earlier in this section*) and the value of the known measurand is recorded in the *A/D Span Mass* setpoint (*see Span Mass under Calibration Setpoints earlier in this section*).

The command sequence for the span calibration function is defined as:

SPAN [<*channel*>] [=<*value*>] ENTER

WHERE:

* <*channel*> is the analog input's channel number (*as defined under Analog Inputs in the APL-section of the Applications Manual*) for which the span calibration is to be performed. This <*channel*> parameter is optional and only need be specified for channels 2 onwards. If <*channel*> is omitted, channel #1 will be assumed.
* <*value*> indicates the optional known value of the measurand (*which is only required when calibrating for a known measurand value which is different to that of the previous span calibration*). If <*value*> is omitted, the value of the previous calibration (*ie. Span Mass setpoint value*) will be used.
* [] indicate optional parameters.

PROCEDURE: Span Calibration

The procedure (*which is independent of the type of measurand*) for the span calibration function (*assuming a scale is to be calibrated*) is as follows:

* Ensure that the scale is empty.
* Select the scale mass parameter (*normally "SM= 00,0 Kg RD"*) for display on the top

display line.

* Place the calibration mass onto the weighing part of scale.
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).
* Press SPAN <*channel*> = <*mass*> ENTER where <*channel*> is the analog input's channel number (*see Analog Inputs in the APL-section of the Applications Manual*) for which the span calibration is to be performed.
* Return the front panel key-switch to the *AUTO* position.
* Ensure that the scale mass parameter on the top display line indicates the entered <*mass*> value.
* Remove the calibration mass from the scale.
* Ensure that the scale mass parameter on the top display line indicates zero (*see NOTE below*).

This concludes the span calibration.

NOTE: After the span calibration has been performed, always ensure that the scale parameter indicates the correct mass when the calibration mass (*or any mass*) is placed on the scale. Also ensure that the scale parameter indicates zero when the calibration mass is removed. If this is not the case (*assuming the span calibration was performed properly*) repeat both the zero and the span calibration.

THE SELECTED CALIBRATION MASS MUST BE BETWEEN 50% (ABSOLUTE MINIMUM 10%) AND 100% OF THE TOTAL LOADCELL CAPACITY.

3.10 Linearization

The linearization function records the nonlinear response of a transducer (*and plot a graph of equal and opposite non linearity*) to be able to compensate for the non linearity and represent the measurand as what appears to be a linear value.

The command sequence for the linearization function is defined as:

SPAN [<*channel*>] TEST [<*point(s)*> [=<*value*>]] ENTER

WHERE:

* <*channel*> is the analog input's channel number (*as defined under Analog Inputs in the APL-section of the Applications Manual*) for which linearization is to be performed. The <*channel*> parameter is optional and only need be specified for channels 2 onwards. If <*channel*> is omitted, channel #1 will be assumed.
* <*point(s)*>
  * when initialising the linearization function (*ie.* =<*value*> is specified), <*point*> indicates the number of points that should be recorded during the linearization function, alternatively,
  * when performing linearization (*ie.* =<*value*> *is omitted*), <*point*> indicates the point on

the curve for which the linearization value is to be recorded.
The maximum number of points that may be linearized is 20.

* *<value>* is the mass increment required between two successive points of linearization. If *<value>* is specified, the linearization function is initialised. If *<value>* is omitted, then the linearization value if the specified point is recorded. If both *<point(s)>* and *<value>* are omitted, then the linearization function is disabled.
* [] indicate optional parameters.

NOTE: *<value>* * *<point(s)>* = SPAN MASS specifies the full operating range of the linearization function. It is not permitted to enable the linearization functions for only part of the full operating range of the system. Once enabled, linearization may only be performed for part of the operating range. In this case the remainder of the operating range will not be linearized.

From the definition if the command sequence of the linearization function, we may define the following functions (*as indicated in TABLE CAL-3*) that may be performed (*in this case channel #1*) by the linearization function.

COMMAND SEQUENCE	DESCRIPTION OF FUNCTION
SPAN 1 TEST ENTER	Disable linearization
SPAN 1 TEST 10=1,00 ENTER	Initialize channel #1's linearization for 10 points, with mass increments of 1.00 each, ie., full operating range of 10,00.
SPAN 1 TEST 1 ENTER	Linearize point 1 using 1.00 Kg of mass
SPAN 1 TEST 2 ENTER	Linearize point 2 using 2.00 Kg of mass
SPAN 1 TEST 9 ENTER	Linearize point 9 using 9.00 Kg of mass

TABLE CAL-3: Some examples of the functions that may be performed by the linearization procedure.

PROCEDURE: Linearization

Before performing linearization, the operating range and the number of points to successfully linearize the measurand should be established. For the purpose of this procedure it is assumed that:

* A loadcell connected to channel #1 needs linearization.
* The full operating range of the scale is 20,00 Kg.
* A ten-point linearization (*thus using an incremental mass of 2,00 Kg*) will satisfy the linearity requirements of the scale.
* That a resolution of 0,01 kg will satisfy the accuracy requirements of the system.

The procedure (*which is independent of the type of measurand*) for performing the linearization function (*assuming a scale is to be linearized*) is as follows:

* Ensure that the scale is empty.
* Perform the zero calibration function as described under *Zero Calibration* earlier in this section.
* Select the scale mass parameter (*normally "SM= 00,0 Kg RD"*) for display on the top display line.
* Put 10 x 2,00 Kg test masses on the scale.
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).
* Enter the command sequence for enabling the linearization function, ie., SPAN TEST 10=2 ENTER.
* Ensure that the scale mass parameter on the top display line indicates 20,00 kg (*10 x 2,00 Kg*).
* Remove one of the 2,00 Kg test masses from the scale.
* Enter the command sequence for recording the 9th point of the linearization curve, ie., SPAN TEST 9 ENTER (*since 9 x 2,00 kg test masses are still on the scale*).
* Ensure that the scale mass parameter on the top display line indicates 18,00 Kg (*9 x 2,00 Kg*).
* Repeat the previous three steps for the 8 remaining points of the linearization curve (*ie., until SPAN TEST 1 ENTER has been completed with only 1 x 2,00 Kg test mass left on the scale*).
* Remove the last 2,00 kg test mass from the scale.
* Ensure that the scale mass parameter on the top display line indicates 0,00 Kg (*0 x 2,00 kg*).
* Return the front panel key-switch to the *AUTO* position.

This concludes the procedure for linearization.

NOTE: After completion of linearization, only the zero calibration may be performed. No normal span calibration is allowed as this will disable the linearization curve. Whenever a span calibration is required, this may be performed as described in the procedure below.

* Ensure that the scale is empty.
* Select the scale mass parameter (*normally "SM= 00,0 Kg RD"*) for display on the top display line.
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).
* Place 1 x 2,00 Kg test mass on the scale.
* Enter the command sequence for recording the 1st point off the linearization curve, ie., *SPAN TEST 1 ENTER.*
* Ensure that the scale parameter on the top display line indicates 2,00 Kg (*1 x 2,00 kg*).
* Repeat the previous three steps for the remaining points off the nonlinear curve (*ie., until SPAN TEST 9 ENTER has been performed with 9 x 2,00 kg test masses on the scale*).
* Place the tenth 2,00 Kg test mass on the scale.

* Enter the command sequence for recording the 10th point off the nonlinear curve, ie., *SPAN TEST 10 ENTER*.
* Ensure that scale mass parameter on the top display line indicates 20,00 Kg (*10 x 2,00 kg*).
* Remove all the test masses from the scale.
* Ensure that the scale mass parameter on the top display line indicates 0,00 Kg (*0 x 2,00 kg*).
* Return the front panel key-switch to the *AUTO* position.

This concludes the procedure for linearization.

4 Analog O/P Calibration

The analog output channels of the system consist only of current/voltage outputs. Each of the analog output channels can be calibrated for any one of the following:

* 0-10 Vdc operation,
* 4-20 mAdc operation, or
* 0-20 mAdc operation.

All of the above standards are supported by adjustment only. No modification to the printed circuit card is required.

The calibration functions that need to be performed on all analog output channels include:

* Zero Calibration
* Span Calibration

The analog output that needs to be calibrated has to be identified for all of these calibration functions. For this purpose, each analog output channel has been assigned its own channel number (*as indicated under Analog Outputs in the APL-section of the Applications Manual*).

During the span and zero calibration functions of the analog outputs, the following functions have been assigned to the keys as indicated:

* With the function key-switch in the *CAL* position:
    * **ENTER** to force maximum output (*ie. 20 mA for example*) of the selected analog output channel in which case the <*value*> indicated will be 100.00%.
    * **DELETE** to force minimum output (*ie. 0 mA for example*) of the selected analog output channel in which case the <*value*> indicated will be 0.00%.
    * **0..9** to enter a <*value*> to force a <*value*>% output (*ie. 0 = 0 mA, 50.00% = 13 mA, 100.00% = 22 mA, ... etc.*). The <*value*> may be any numeric value which is required within the range of 0 to 100.00% and specifies the required output percentage. If the entered value exceeds the maximum value (*ie., 100.00%*) then the value will be reset to zero. The value may be cleared by means of the *DELETE* key.
    * **NEXT** to increment the output value by 10.00%.

* **PREV** to decrement the output value by 10.00%.

* With the function key-switch in the *AUTO* position:

  * **NEXT** to select the zero/span calibration of the next channel.
  * **PREV** to select the zero/span calibration of the previous channel.
  * **CANCEL** to cancel the zero/span calibration function.

4.1 Analog Output Zero/Span Calibration using Potentiometers

With older software and hardware, the zero and span calibration was performed by adjustment of potentiometers provided on the analog outputs. This procedure only pertains to those systems.

All software since the start of 1995 makes provision for calibration of the analog outputs via the front panel keyboard. Where potentiometers are still available with this software, adjust the zero potentiometer for minimum zero (*ie. 0Vdc/0mA*) and use the keyboard calibration functions provided. You are free however to still make use of the potentiometers if available.

4.1.1 Zero/Span Calibration Command

The command sequence for performing the analog output zero calibration function is defined as:

TEST 7[<*channel*>] ENTER

WHERE:

* <***channel***> is the analog output's channel number (*as defined under Analog Outputs in the APL-section of the Applications Manual*) to be calibrated. If the <*channel*> parameter is omitted, analog output #1 will be assumed.
* [] indicate optional parameters.

After the entry of the command sequence for the zero/span calibration function of any on of the analog output channels, the display will appear as indicated below:

mA O/P #<*channel*> = <*value*>

WHERE:

* <***channel***> is the analog output's channel number (*as defined under Analog Outputs in the APL-section of the Applications Manual*) which is to be calibrated.
* <***value***> is the current output value of the selected <*channel*> which may range from 0 to 100.00%.

The zero and span adjustments of the analog O/P channels are done with PCB mount potentiometers which are identified under *Analog Outputs* in the *SYS*-section of the *Systems Manual.*

NOTE: If an analog output is to be used for driving mA devices, it may be required to remove the terminations (*see Analog Outputs in the SYS-section of the Systems Manual*) if there is an impedance mismatch between the analog outputs of the ***Route*** controller and the analog inputs of the remote mA devices. This impedance mismatch will be noted by the fact that the span of the analog output does not reach 20 mA, but instead only approximately between 12 and 18 mA.

4.1.2 Zero/Span Calibration Procedure

The procedure for the Zero and Span Calibrations functions (which are independent of the analog output type) of the analog outputs is as follows:

* Connect a milliampere meter in line with (*or a voltmeter across*) the analog output to be calibrated.
* Enter the command sequence for the Zero/Span calibration function (*for channel #1, TEST 71 ENTER*).
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).
* Press the *DELETE* ("←") key.
* Ensure that the display indicates: "*mA O/P #1 = 0.00%*".
* Turn the zero adjustment potentiometer (*as indicated under Analog Outputs in the SYS-section of the Systems manual*) until the minimum output (*0V,0mA or 4mA depending on the requirements*) is acquired.
* Press the *ENTER* key.
* Ensure that the display indicates: "*mA O/P #1 = 100.00%*"
* Turn the span adjustment potentiometer (*as indicated under Analog Outputs in the SYS-section of the Systems Manual*) until the maximum output (*10 V or 20 mA depending on the requirements*) is acquired.
* Recheck both the zero and the span adjustments and readjust if required.
* Return the front panel key switch to the *AUTO* position.
* Press the *CANCEL* key.

This concludes the mA O/P calibration. Repeat this procedure for any of the other outputs if required.

4.2 Analog Output Zero Calibration via Keyboard Functions

NOTE: Only available for software revisions later than beginning of 1995.

4.2.1 Analog Output Zero Calibration Command

The command sequence for performing the analog output zero calibration function is defined as:

TEST 7 ZERO [<*channel*>] ENTER

WHERE:

* *<channel>* is the analog output's channel number (*as defined under Analog Outputs in the APL-section of the Applications Manual*) to be calibrated. If the <*channel*> parameter is omitted, analog output #1 will be assumed.
* [] indicate optional parameters.

After the entry of the command sequence for the zero calibration function of any on of the analog output channels, the display will appear as indicated below:

mA O/P #<*channel*> = <*value*>

WHERE:

* *<channel>* is the analog output's channel number (*as defined under Analog Outputs in the APL-section of the Applications Manual*) which is to be calibrated.
* *<value>* is the current output value of the selected <*channel*> which may range from 0 to 100.00%.

NOTE: If the analog output is to be used for driving mA devices, it may be required to remove the terminations (see Analog Outputs in the SYS-section of this manual) if there is an impedance mismatch between the analog outputs of the ROUTE controller and the analog inputs of the remote mA devices. This impedance mismatch will be noted by the fact that the span of the analog output cannot reach 20 mA, but instead only approximately between 12 and 18 mA.

4.2.2 Analog Output Zero Calibration Procedure

The procedure for the zero calibration function (*which are independent of the analog output type*) of the analog outputs is as follows:

* Connect a milliampere meter in line with (*or a voltmeter across*) the analog O/P to be calibrated.
* Enter the command sequence for the zero calibration function (*for channel #1, TEST 7 ZERO 1 ENTER*).
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).
* Enter the required amount of zero adjustment (*normally between 16.00% and 20.00% for 4mA, or 0.00% for 0V*) by utilizing the numeric keys (*ie. 1750 for 17.50% NB. Don't press the ENTER key*).
* By watching the milliampere meter/voltmeter, trim the zero adjustment by pressing and holding the *NEXT* or *PREV* key until the required setting is achieved. If the setting is still far of, simply press *CANCEL* to retain the current value and reenter the next value as indicated in the previous step.
* Return the front panel key switch to the *AUTO* position.
* Press the *CANCEL* key.

NOTE: Since a 100.00% will provide ±22mA, you may use increments of ±0.50% to get the zero adjustment within 0.1mA of the wanted value after which you may utilize the *NEXT* and *PREV* keys to trim the output to the exact value required.

This concludes the analog output zero calibration function. Repeat this procedure for any of the other outputs if required.

4.3 Analog Output Span Adjustment via Keyboard Functions

NOTE: Only available for software revisions later than beginning of 1995.

4.3.1 Analog Output Span Adjustment Command

The command sequence for performing the analog output span calibration function is defined as:

TEST 7 SPAN [<*channel*>] ENTER

WHERE:

* <*channel*> is the analog output's channel number (*as defined under Analog Outputs in the APL-section of the Applications Manual*) to be calibrated. If the <*channel*> parameter is omitted, analog output #1 will be assumed.
* [] indicate optional parameters.

After the entry of the command sequence for the span calibration function of any on of the analog output channels, the display will appear as indicated below:

mA O/P #<*channel*> = <*value*>

WHERE:

* <*channel*> is the analog output's channel number (*as defined under Analog Outputs in the APL-section of the Applications Manual*) which is to be calibrated.
* <*value*> is the current output value of the selected <*channel*> which may range from 0 to 100.00%.

NOTE: If the analog output is to be used for driving mA devices, it may be required to remove the terminations (see Analog Outputs in the SYS-section of this manual) if there is an impedance mismatch between the analog outputs of the ***Route*** controller and the analog inputs of the remote mA devices. This impedance mismatch will be noted by the fact that the span of the analog output cannot reach 20 mA, but instead only approximately between 12 and 18 mA.

4.3.2 Analog Output Span Adjustment Procedure

The procedure for the span calibration function (*which are independent of the analog output type*) of the analog outputs is as follows:

* Connect a milliampere meter in line with (*or a voltmeter across*) the analog O/P to be calibrated.
* Enter the command sequence for the span calibration function (*for channel #1, TEST 7 SPAN 1 ENTER*).
* Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).
* Enter the required amount of span adjustment (*normally between 94.00% and 97.00% for 20mA or 10V, 47.00% to 49.00% for 10mA or 5V*) by utilizing the numeric keys (*ie. 9550 for 95.50% NB. **Don't press the ENTER key***).
* By watching the milliampere meter/voltmeter, trim the span adjustment by pressing and holding the *NEXT* or *PREV* key until the required setting is achieved. If the setting is still far of, simply press *CANCEL* to retain the current value and reenter the next value as indicated in the previous step.
* Return the front panel key switch to the *AUTO* position.
* Press the *CANCEL* key.

NOTE: Since a 100.00% will provide ±22mA, you may use increments of ±0.50% to get the zero adjustment within 0.1mA of the wanted value after which you may utilize the *NEXT* and *PREV* keys to trim the output to the exact value required.

This concludes the analog output span calibration function. Repeat this procedure for any of the other outputs if required.

TABLE OF CONTENTS

1 Preface

This section contains a discussion of the totalising and stock level control functions of the ***Route** Series Controllers*. A detailed explanation of the setup functions and the management of the system totalisers and stock level control are included.

2 Introduction

The system provides for the totalising of the following parameters:

* Active run time of the system,
* Number of completed batches,
* Material consumption of all products.

The totalising of these parameters is done at various levels, ie, Hourly, Daily, Monthly, etc.

In addition to the totalising function, the system maintains a stock balance on all products. This is useful to forecasting the purchase of new stock.

Together, the totalising function and material stock balance provides a complete management reporting system.

3 Totaliser Types

The system provides for the totalising of the following parameters, commonly known as totaliser types:

* Batch Counter (*Number of Runs for Belt Weighers/Weigh Feeders etc.*)
* Active Running Time
* Material Consumption per Product

Each totaliser type has been assigned a <*type*> value. The <*type*> is used in the management of the totalisers such as displaying, resetting, etc. The assigned <*type*> values are summarized in *TABLE TOT-1* below.

TYPE	DISPLAY	UNIT/RANGE	DESCRIPTION
0	Count	Cnts/Runs	Batch Counter/Number Of Runs
1	Time	Time Units	Active Running Time
2	Name1	Mass Units	Material Consumption Product #1
3	Name2	Mass Units	Material Consumption Product #2

TYPE	DISPLAY	UNIT/RANGE	DESCRIPTION
...	...	...	...
21	Name21	Mass Units	Material Consumption Product #20

TABLE TOT-1: A complete list of the totaliser types indicating the <type> value assigned to each totaliser type.

Each totaliser type can be cleared separately or as a group.

3.1 Batch Counter

The batch counter totalisers (*or number of runs*) make provision for totalising for example:

* The number of times a batch/recipe has been completed
* The number of times a belt weigher/weigh feeder has been run/stopped
* The number of times a target has been fulfilled

Totalising of the number of operations allows for the calculation of averages such as:

* average mass of each product per batch/recipe
* average mass of each batch/recipe
* average mass per run of a belt

3.2 Active Running Time

The running time totalisers make provision for the totalising of the active running time of the system. This does not include any standing time during operation.

The running time is started when the system is started and is stopped whenever the system is stopped, or the required task has been completed. Also, the running time will be stopped whenever the system is awaiting external events such as a confirmation from the operator to discharge, etc. The running time totaliser is directly linked to the *Busy* and *Ready* lights on the front panel of the ***Route*** controller. If the *Ready* light is lit, the running time totaliser is stopped. When the *Busy* light is lit, the running time totaliser is running.

The totalised running time allows for the calculation of useful management information such as the effective throughput of the system.

The unit of measurement within which the running time is totalised is programmed by means of the totaliser setpoints (*see Totaliser Setpoints later in this section*).

3.3 Material Consumption

The material consumption totalisers allow for the individual totalising of material consumption

by product. The product being batched and totalised is defined by the selection of the target (*see Target Setup and Target Selection in the TRG-section of the Applications Manual*).

The totalising of the material consumption provides invaluable information such as:

* Total consumption of each product
* Total throughput of the system
* Average consumption of each product per batch/recipe/day etc.
* Average throughput of the system

4 Totaliser Levels

Each of the parameters is totalised at different levels. These levels are commonly known as the totaliser levels. The levels at which all parameters are totalised, are:

* Total, Batch/Run, Group/Recipe, Hourly, Shift, Daily, Weekly, Monthly and Yearly

Each of the totaliser levels has been assigned a *<level>*. The *<level>* is used during the totaliser functions (*such as the display and clearing of totalisers*) for referencing the required totaliser level. The *<level>* assigned to each totaliser level is summarized in *TABLE TOT-2* below.

LEVEL	DISPLAY	DESCRIPTION
1	Total	Totalised values since last reset
2	Batch/Recip	Totalised values for last batch/recipe
3	Group/Batch	Totalised values for a group/batch of batches/recipes
4	Hour	Totalised values for the hour
5	Shift	Totalised values for the shift
6	Daily	Totalised values for the day
7	Week	Totalised values for the week
8	Month	Totalised values for the month
9	Year	Totalised values for the year

TABLE TOT-2: A summary of the totaliser levels which have been defined identifying the <level> which has been assigned to each totaliser level.

Each of the totalising levels can be cleared separately or as a group.

4.1 TOTAL Totaliser

The *TOTAL* totaliser continuously totalises all totaliser types.

This totaliser is not in any way used or cleared by the system. All management reporting relating to and clearing of this totaliser level has to be manually requested.

This totaliser may be used for any purpose to suit the requirements of the installation for example:

* Manual recording of the totalisers for odd events
* Creating undefinable totalising intervals such as biweekly which can be manually activated

4.2 BATCH/RECIP Totaliser

The *BATCH/RECIP* totaliser allows for the totalising of all totaliser types for the current batch/recipe (*or run for belt weighers/weigh feeders*).

A batch/recipe report is generated to reflect the state of the batch/recipe totalisers when a batch or recipe has been completed.

The batch/recipe totalisers will be cleared with the start of a new batch or recipe.

4.3 GROUP/BATCH Totaliser

The *GROUP* totaliser allows for the totalising of all totaliser types for a group of batches or batch of recipes.

This totaliser level only applies to systems where a number of batches can be grouped together such as with recipe batching systems.

A group/batch report is generated to reflect the state of the group/batch totalisers when a group of batches or batch of recipes has been completed.

The group/batch totalisers will be cleared with the start of the next group of batches or batch of recipes.

4.4 HOURLY Totaliser

The *HOURLY* totaliser allows for the totalising of all totaliser types on an hourly basis.

An hourly report is generated to reflect the state of the hourly totalisers at the turn of every hour.

All totalisers at this level will be cleared with the start of the first batch or recipe after the turn of an hour.

4.5 SHIFT Totaliser

The *SHIFT* totaliser allows for the totalising of all totaliser types on a shift basis.

The system allows the day to be divided into three shifts. The starting times of the three shifts is defined by the reporting functions (*see Printer Setpoints in the REP-section later in this manual*).

A shift report is generated to reflect the state of the shift totalisers at the turn of an hour which coincides with the start of a new shift. Consequently, the hourly report will be generated as well when the shift report is generated.

The shift totalisers will be cleared with the start of the first batch or recipe after the turn of a shift.

4.6 DAILY Totaliser

The *DAILY* totaliser allows for the totalising of all totaliser types on a daily basis.

The start of a day is defined to coincide with the start of shift #1. The starting time of shift #1 is defined by the reporting functions (*see Printer Setpoints in the REP-section later in this manual*).

A daily report is generated to reflect the state of the daily totalisers at the turn of an hour which coincides with the start of the day. Consequently, the hourly and shift reports will be generated as well when the daily report is generated.

The daily totalisers will be cleared with the start of the first batch or recipe after the turn of the day.

4.7 WEEKLY Totaliser

The *WEEKLY* totaliser allows for the totalising of all totaliser type on a weekly basis.

The start of a week is defined to coincide with the start of shift #1 on the first day of the week. The starting time of shift #1 is defined by the reporting functions (*see Printer Setpoints in the REP-section of this manual*). The day of the week is selected during the real time clock setup (*see Real Time Clock in the CNF-section earlier in this manual*). For the weekly report to be generated on for example, Wednesday, Wednesday should be set to day one when setting the real time clock.

A weekly report is generated to reflect to state of the weekly totalisers at the turn of an hour which coincides with the start of the week. Consequently, the hourly, shift and daily reports will be generated as well when the weekly report is generated.

The weekly totalisers will be cleared with the start of the first batch or recipe after the turn of the week.

4.8 MONTHLY Totaliser

The *MONTHLY* totaliser allows for the totalising of all totaliser types on a monthly basis.

The start of a month is defined to coincide with the start of shift #1 on a specified day of the month. Both the starting time of shift #1, and the day on which a month starts is defined by the reporting functions (*see Printer Setpoints in the REP-section of this manual*).

A monthly report is generated to reflect the state of the monthly totalisers at the turn of an hour which coincide with the start of the month. Consequently, the hourly, shift, daily and weekly reports will be generated as well when the monthly report is generated.

The monthly totalisers will be cleared with the start of the first batch of the month after the turn of the month.

4.9 YEARLY Totalizer

The *YEARLY* totaliser allows for the totalising of all totaliser types on a yearly basis.

The start of the year is defined to coincide with the start of shift #1 on a specified day and month of the year. The starting time of shift #1, the first day of the month and first month of the year is defined by the reporting functions (*see Printer Setpoints in the REP-section of this manual*).

A yearly report is generated to reflect the state of the yearly totalisers at the turn of an hour which coincides with the start of the year. Consequently, the hourly, shift, daily, weekly and monthly reports will be generated as well when the yearly report is generated.

The yearly totalisers will be cleared with the start of the first batch of the year after the turn of the yearly.

5 Totaliser Setpoints

The totaliser setpoints define the operational parameters of the totalising functions. An identical set of setpoints has been defined for each of the totalising channels.

The format of the command sequence required to access the calibration setpoints is defined as:

TOTAL [<*channel*>] SETP [<*reference*>] ENTER

WHERE:

* <***channel***> identifies the totaliser channel of interest. The <*channel*> is only required for multi-channel systems where more than one channel has been defined within the system as in dual batching systems etc. When the <*channel*> parameter is omitted, the default channel, which is channel #1, will be assumed.
* <***reference***> identifies the setpoint reference number which is to be accessed. If the

<reference> parameter is omitted, then the last selected reference will be assumed.

* [] indicate optional parameters. When the parameters within these brackets are not specified, then the default parameters will be assumed.

A complete list of *Totaliser Setpoints*, which has been defined for each of the totalising channels, is provided in *TABLE TOT-3* below. These totaliser setpoints must be programmed as set out under *Setpoint Programming* in the *CNF*-section earlier in this manual.

An identical list of *Totaliser Setpoints* is also included in the *COM*-section of the *Applications Manual*. After completion of the totaliser setup, the actual values programmed for each of the totaliser setpoints should be recorded in the space provided.

5.1 TABLE: TOTAL SETP ENTER

5.2 TABLE: TOTAL 1 SETP ENTER

NO	DISPLAY	UNIT/RANGE	VALUE	DESCRIPTION
1	MassEng	0..4		Mass Engineering Unit
2	MassDeci	0..3		Mass Decimal Precision
3	TotlEng	0..4		Total Engineering Unit
4	TotlDeci	0..3		Total Decimal Precision
5	TimeEng	0..4		Time Engineering Unit
6	TimeDeci	0..3		Time Decimal Precision

TABLE TOT-3: A list of set points which defines the totalising parameters of channel #1.

5.3 Totaliser Setpoint Definitions

There are two groups of totaliser setpoints to define the totalising requirements of the totalising functions which are:

* Setpoints to define the totalising requirements of material consumption.
* Setpoints to define the totalising requirements of running time.

5.3.1 Material Consumption

The material consumption totalisers are grouped into two categories, the short term and long term totalisers. The totalising unit and precision of each of these categories are defined independently.

The short term totalisers are those for the Batch, Group, Hour, Shift and Daily totalisers. The engineering unit and precision of these totalisers are programmed by means of the Mass

Engineering Unit and Decimal Position setpoints (*see **MassEng** and **MassDeci** later in this section*)

The long term totalisers are those for the Total, Weekly, Monthly and Yearly totalisers. The engineering unit and precision of these totalisers are programmed by means of the Total Engineering Unit and Decimal Position setpoints (*see **TotlEng** and **TotlDeci** later in this section*).

The base unit and resolution of the material consumption totalisers are the same as that of the indicated mass on the display. This is therefor the finest sensible unit and resolution to select.

The two types of setpoints, which define the totalising requirements of material consumption, are:

* Engineering Unit
* Decimal Precision

By programming these setpoints, the user is able to match the totalising of material consumption with his requirements.

5.3.1.1 Engineering Unit

The Engineering Unit selects the engineering unit in which the mass should be totalised for example tonnes, killogrammes, etc. The engineering unit is selected by setting the engineering unit setpoint to a value between 0 and 4. This engineering unit that will be selected for each of these settings are as indicated in *TABLE TOT-4* below (*see Engineering Units in the CNF-section earlier in this manual*). Any value in excess of 4 will be ignored.

UNIT/VALUE	0	1	2	3	4
Mass	Kton	ton	Kg	gm	mg

TABLE TOT-4: The engineering units that may be selected for the totalising of mass. The indicated value should be programmed to select the engineering unit required.

5.3.1.1.1 (MassEng) - Mass Eng. Unit

The *Mass Engineering Unit* setpoint selects the engineering unit in which the material consumption for the Batch, Group, Hour, Shift and Daily totalisers are totalised.

The *Mass Engineering Unit* setpoint may be set to a value of between 0 and 4 which will select the engineering unit as indicated in *TABLE TOT-4* below (*see also Engineering Units in the CNF-section later in this manual*). Any value in excess of 4 will be ignored.

Since this setpoint defines the resolution of the totalised material consumption, once set, it should not be changed. If this is attempted, material consumption of different engineering units will be added together assuming the same engineering unit. This will result in an incorrect display for the

totalised values.

If it is required to change the engineering unit, all the totalisers should be recorded, the engineering unit changed, and the totalisers reset to zero.

5.3.1.1.2 (TotlEng) - Total Eng. Unit

The *Total Engineering Unit* setpoint selects the engineering unit in which the material consumption of the Total, Weekly, Monthly and Yearly totalisers are totalised.

The *Mass Engineering Unit* setpoint may be set to a value of between 0 and 4 which will select the engineering unit as indicated in TABLE TOT-4 below (*see also Engineering Units in the CNF-section later in this manual*). Any value in excess of 4 will be ignored.

Since this setpoint defines the resolution of the totalised material consumption, once set, it should not be changed. If this is attempted, material consumptions of different engineering units will be added together assuming the same engineering unit. This will result in an incorrect display for the totalised values.

If it is required to change the engineering unit, all the totalisers should be recorded, the engineering unit changed, and the totalisers reset to zero.

5.3.1.2 Decimal Precision

The Decimal Precision selects the precision to which the material consumption should be totalised, for example 0, 0.1, 0.01, etc. The value of the Decimal Precision setpoints may be set to any value between 0 and 3, resulting in a precision of 0 to 0.001 respectively. A decimal precision value in excess of 3 will be ignored.

5.3.1.2.1 (MassDeci) - Mass Decimal Position

The *Mass Decimal Precision* setpoint defines the precision to which the material consumption of the Batch, Group, Hour, Shift and Daily totalisers are totalised.

The *Decimal Precision* setpoint may be programmed to a value of between 0 and 3. This will select a precision of between 1 and 0.001 respectively. A decimal precision value in excess of 3 will be ignored.

Because this setpoint defines the resolution to which the material consumption is totalised, once set, it should not be changed. If this is attempted material consumption of different precision will be added together assuming the same precision. This will result in an incorrect display for the totalised values.

If it is required to change the decimal position, all the totalisers should be recorded, the decimal position changed, and the totalisers reset to zero.

5.3.1.2.2 (TotlDeci) - Total Decimal Position

The *Total Decimal Precision* setpoint defines the precision to which material consumption of the Total, Weekly, Monthly and Yearly totalisers are totalised.

The *Decimal Precision* setpoint may be set to a value of between 0 and 3 which will result in a precision of between 1 and 0.001 respectively. Any value in excess of 3 will be ignored.

Since this setpoint defines the resolution to which to material consumption is totalised, once set, it should not be changed. If this is attempted, material consumption of different precision will be added together assuming the same precision. This will result in an incorrect display for the totalised values.

If it is required to change the decimal position, all the totalisers should be recorded, the decimal position changed, and the totalisers reset to zero.

5.3.2 Totalised Running Time

There are two types of setpoints which define the totalising requirements of running time. They are defined as:

* Engineering Unit
* Decimal Position

By programming these setpoints, the user is able to set the totalising of running time to match his requirements.

The base unit and decimal resolution of running time is 1 second. This is therefor the finest sensible unit and decimal resolution that can be selected.

5.3.2.1 (TimeEng) - Time Engineering Units

The *Time Engineering Unit* setpoint selects the engineering unit in which the running time should be totalised for example hours, minutes, seconds, etc.

VALUE / UNIT	0	1	2	3	4
Time	Hrs	Mins	Secs	mSec	

TABLE TOT-5: *The engineering units that may be selected for the totalising of running time. The indicated value should be programmed to select the engineering unit required.*

The *Time Engineering Unit* setpoint may be set to a value of between 0 and 4 which will select

the engineering unit as indicated in *TABLE TOT-5* below (*also see Engineering Units in the CNF-section earlier in this manual*). Any value in excess of than 4 will be ignored.

Since this setpoint defines the engineering unit of the totalised running time, once set, the value of this setpoint should not be changed. If this is attempted, times of different engineering units will be added together assuming the same engineering unit. This will result in an incorrect display for the totalised values.

If it is required to change the engineering unit, all the totalisers should be recorded, the engineering unit changed, and the totalisers reset to zero.

5.3.2.2 (TimeDeci) -Time Decimal Position

The *Time Decimal Precision* setpoint defines the precision to which the running time should be totalised for example 0, 0.1, 0.01, etc.

The *Time Decimal Precision* may be selected for any value between 0 and 3, resulting in a precision of 0 to 0.001 respectively. Any value in excess of 3 will be ignored.

Since this setpoint defines the decimal resolution of the totalised running time, once set, the value of this setpoint should not be changed. If this is attempted, totalisers of different decimal precision will be added together assuming the same precision. This will result in an incorrect display for the totalised values.

If it is required to change the decimal position, all the totalisers should be recorded, the decimal position changed, and the totalisers reset to zero.

6 Display Totalisers

A facility has been provided to view the totalised values on the display unit of the ***Route*** controller. The totalised value of any parameter at any level may be viewed. When a totaliser is selected for display, the contents of that totaliser will not and cannot be altered.

The general format of the command for the display of a totaliser is:

TOTAL [<*channel*>[<*level*>[<*type*>]]] ENTER

WHERE:

* <***channel***> is the channel number for which the totaliser is to be displayed. The <*channel*> parameter only need be specified if more than one totaliser channel has been defined for the system. If the <*channel*> parameter is omitted, the default channel, which is Channel #1, will be assumed.
* <***level***> is the level of the totaliser to be displayed as defined in *TABLE TOT-2* under *Totaliser Levels*. If the <*level*> parameter is omitted, the default level which is *TOTAL* will be assumed. To be able to specify the <*type*> parameter, the <*level*> parameter has to be

specified.

* *<type>* is the type of the totaliser to be displayed as defined under *Totaliser Types* in *TABLE TOT-1* earlier in this section. If the *<type>* parameter is omitted, the default totaliser type, being the batch counter, will be assumed. To be able to specify the *<type>* parameter, the required *<level>* has to be specified.
* [] indicate optional parameters. If the optional parameters are not specified, the default parameters will take effect as indicated.

After entry of the command for the display of a totaliser, the following keys will take effect:

* **NEXT, ENTER** will advance you to the next totaliser *<type>*. When the last totaliser *<type>* of a *<level>* is being displayed, the next totaliser to be displayed will be the first *<type>* of the next *<level>*. When the last totaliser *<type>* of the highest *<level>* is being displayed, the next totaliser to be displayed will be the first totaliser *<type>* of the lowest *<level>*.
* **PREV, DELETE** will revert back to the previous totaliser *<type>*. When the first totaliser *<type>* of a *<level>* is being displayed, the next totaliser to be displayed will be the last *<type>* of the previous *<level>*. If the first totaliser *<type>* of the lowest *<level>* is being displayed, the next totaliser to be displayed will be the last totaliser *<type>* of the highest *<level>*.
* **CANCEL** will terminate the display of totalisers, freeing the system console for other functions.

NOTE: It is **NOT** possible to change the channel number without reentering the display command and identifying the required channel number.

During the display of totalisers, the display will take on the following format:

<ident>=<value>

WHERE:

* *<ident>* is the identifier of the total being displayed. The *<ident>* will alternate at intervals of ±0,5 seconds, to indicate the *Totaliser Level*, *Totaliser Type* and *Engineering Unit*. If more than one channel has been defined within the system, the channel ident will also be displayed as part of the alternating sequence.
* *<value>* is the current value of the totaliser being displayed.

NOTE: Whenever the material consumption totalisers are displayed, the totaliser type will identify the product being displayed by displaying its product name/code as has it been defined under *TARGET SETP ENTER* (*see Product Names/Codes in the TRG-section of the Applications Manual*).

6.1 Display First Totaliser

The first totaliser, being the batch counter for the *TOTAL* level, may be called up for display by

using the default values for both *Totaliser Type* and *Totaliser Level*. Thus, the totaliser display command may be entered as follows:

TOTAL ENTER

NOTE: The same effect can be achieved by entering one of the following commands:

TOTAL 1 ENTER or
TOTAL 10 ENTER

The other totalisers may now be displayed by using the *NEXT*, *ENTER*, *PREV* and *DELETE* keys as described earlier in this section. Alternatively, the totaliser display command may be cancelled by pressing the *CANCEL* key, and new totaliser display command entered which identifies the required *Totaliser Level* and *Totaliser Type*.

6.2 Display a Specific Level

The first totaliser of a specific totaliser level (for example *HOURLY* which is level 4), being the batch counter of that level, may be called up for display, by using the default value for *Totaliser Type*, and only specifying the required *Totaliser Level*. Thus, the totaliser display command may be entered as follows:

TOTAL 4 ENTER

NOTE: The same effect can be achieved by entering the totaliser display command as:

TOTAL 40 ENTER

The other totalisers may now be displayed by using the *NEXT*, *ENTER*, *PREV* and *DELETE* keys as described at the beginning of this section. Alternatively, the totaliser display command may be cancelled by pressing the *CANCEL* key, and a new totaliser display command entered which identifies the required *Totaliser Level* and *Totaliser Type*.

6.3 Display a Specific Totaliser

A specific totaliser type (for example the material consumption of product #1 which is type 2), of a specific level (for example HOUR which is level 4), may be called up for display, by specifying both the *Totaliser Type* and *Totaliser Level*. Thus, the totaliser display command may be entered as follows:

TOTAL 42 ENTER

The other totalisers may now be displayed by using the *NEXT*, *ENTER*, *PREV* and *DELETE* keys as described at earlier in this section. Alternatively, the totaliser display command may be cancelled by pressing the *CANCEL* key, and a new totaliser display command entered which will

identify the required *Totaliser Level* and *Totaliser Type*.

7 Automatic Clearing of Totalisers

The total totaliser is cleared only when its management report is requested (*see Reporting Facilities in the REP-section later in this manual*).

The batch/recipe totalisers will be cleared automatically when the next batch/recipe is started.

The group/batch totalisers will be cleared automatically when the first batch of a group or first recipe in a batch is started.

All other totalisers will be cleared automatically with the start of the first batch after the beginning of the new time period. With the exception of the weekly totaliser, the starting date/times of these totalisers are defined during printer initialisation (*see Printer Setpoints in the REP-section later in this manual*) as indicated in TABLE TOT-6 below.

TOTALISER LEVEL	STARTING TIME	SETTING
Hourly totaliser	Every hour on the hour	None
Shift totaliser	Shift #1, #2 and #2 starting time	Setpoint
Daily totaliser	Shift #1 starting time	Setpoint
Weekly totaliser	Shift #1 starting time Day one of the week	Setpoint RTC
Monthly totaliser	Shift #1 starting time 1st day of the month	Setpoint Setpoint
Yearly totaliser	Shift #1 starting time 1st day of the month 1st month of the year	Setpoint Setpoint Setpoint

***TABLE TOT-6:** A list of the totaliser levels indicating the definition of their starting times.*

The 1st day of the week is determined by the day of the week setting of the real time clock (*see Real Time Clock Programming in the CNF-section of this manual*).

8 Manual Clearing of Totalisers

In addition to the automatic clearing of totalisers, any of the totalisers or group of totalisers may be manually cleared. Manual clearing of any totaliser is password protected (*see Password below and in the TRG-section of the Applications Manual*). Manual clearing of the totalisers may be performed on:

* A single totaliser
* A group of totaliser of a specific level
* All totalisers simultaneously

NOTE: It is not possible to preset any of the totalisers to a specific value.

PASSWORD: The password is an alphanumeric sequence of five characters which is assigned by the system manager during the initial system setup (*see Password in the TRG-section of the Applications Manual*).

The general format of the command for the clearing of totalisers is defined as:

TOTAL [<*channel*>[<*level*>[<*type*>]]] = <*password*> ENTER

WHERE:

* <***channel***> is the channel number of the totalisers that is to be cleared. The <*channel*> parameter only need be specified if more than one channel has been defined within the system. If <*channel*> is omitted, the default channel being Channel #1 will be assumed. If more than one channel exists, and it is required to enter the <*level*> or <*type*> parameter, then the <*channel*> parameter has to be specified.
* <***level***> is the level of the totaliser which is to be cleared as defined under *Totaliser Levels* in *TABLE TOT-2* earlier in this section. If the <*level*> parameter is omitted, the lowest level, being TOTAL, will be assumed. To be able to specify the <*type*> parameter, the <*level*> parameter has to be specified.
* <***type***> is the totaliser type (*as defined under Totaliser Types in TABLE TOT-1 earlier in this section*) which is to be cleared. If the <*type*> parameter is omitted, the first type, being the batch counter, will be assumed. To be able to specify the <*type*> parameter, the <*level*> parameter has to be specified.
* <***password***> is the user password which has been assigned to the system by the systems supervisor during the initial setup (*see also Password above and in the TRG-section in the Applications manual*).
* [] indicate optional parameters. If an optional parameter is omitted, the default parameters will take effect as indicated.

After successful accomplishment of the request to clear the totalisers, the system will respond with the message:

Totals Cleared!

8.1 Clearing All Totalisers

All the totalisers of a specific channel may be cleared simultaneously by omitting both the *Totaliser Type* and *Totaliser Level* parameters in which case the command should be entered as:

TOTAL =<*password*> ENTER

It is not possible to clear the totalisers of more than one channel with a single command. If more than one channel exists, then the totalisers of each channel have to be cleared separately. The above command will still clear only the totalisers of channel #1. The command to clear all the totalisers of channel #2 for example, have to be entered as:

TOTAL 2=<PASSWORD> ENTER

After successful accomplishment of the request to clear the totalisers, the system responds with the message:

Totals Cleared !

8.2 Clear a Specific Level

All the totalisers of a specific *Totaliser Level* (*for example HOUR which is level 4*) may be cleared simultaneously by omitting the *Totaliser Type* parameter in which case the command should be entered as:

TOTAL 4=<*password*> ENTER

If more than one channel exists, then the channel number has to be specified (*even for channel #1*) in order to clear the totalisers. The above command will then have to be changed to:

TOTAL 14=<*password*> ENTER

After successful accomplishment of the request to clear the totalisers, the system responds with the message:

Totals Cleared !

8.3 Clear a Specific Totaliser

A specific totaliser (*for example the material consumption of product 1, which is TYPE 2*) of a specific *Totaliser Level* (*for example HOUR which is level 4*) may be cleared by specifying both the *Totaliser Type* and *Totaliser Level* in which case the command should be entered as:

TOTAL 42=<*password*> ENTER

If more than one channel exists, then the channel number has to be specified (*even for channel #1*) in order to clear the totaliser in which case the above command for channel #1 will have to be entered as:

TOTAL 142=<*password*> ENTER

After successful accomplishment of the request to clear the totalisers, the system responds with

the message:

Totals Cleared !

9 Material Stock Balance

The system provides for a stock balance on all products controlled by the system to be maintained. This allows for easy management and forecasting on the purchasing of new stock.

The product stock balance is maintained as a set of special stock balance totalisers. These stock balance totalisers are decreased as material is processed.

The way in which the product stock levels are maintained is best described by an example:

EXAMPLE: New stock is purchased and entered into the system as stock. As the product is processed by the system, the processed amounts are transferred from stock to consumed. Thus, at any stage the product consumed + stock balance must equal the stock purchased. This allows for the complete control and management of the product processed by the plant.

The general format of the command for management of the product stock levels is:

TOTAL TARGET <*product*> ENTER

WHERE:

* <*product*> is the product number which has been assigned to the product. During the initial system setup (*see System Setup in the TRG-section of the Applications Manual*), the first product to be assigned a name, will be product number #1, the second, product number #2, etc.

NOTE: The same command format is used both for setting up and the display of the product stock levels. Once a specific product's stock level is displayed, it may be updated by simply entering the new stock level as explained under *Updating Stock Levels* later in this section.

9.1 Displaying Material Stock Levels

The general command format for the display of the product stock levels is as defined above and is explained below by an example.

EXAMPLE:

COMMAND: To display the stock level for product #3, enter the command sequence:

TOTAL TARGET 3 ENTER

DISPLAY: The stock level of product #3 will be displayed as:

<ident>=<stock level>

WHERE:

* *<ident>* is the product identifier which identifies the product for which the stock level is being displayed. The *<ident>* display will alternate between "**STOCK**" and the assigned name of product #3.
* *<stock level>* is the current stock level for the product indicated by *<ident>*.

ACTION: After entering the material stock level display command, other stock levels may be viewed by using the following keys.

* ***NEXT, ENTER*** to advance to the stock level of the next product. If the stock level of the last product is being displayed, the stock level to be displayed, will be the stock level of the first product.
* ***PREV, DELETE*** to revert back to the stock level of the previous product. If the stock level of the first product is being displayed, the next stock level to be displayed, will be the stock level of the last product.
* *CANCEL* to terminate the display of stock levels, freeing the system's console for other functions.

9.2 Updating Material Stock Levels

The command format for updating a product's stock level is as defined above and is explained below by an example.

The stock level for a specific product, once being displayed, may be updated by simply entering the additional stock amount for that product. Stock amounts are entered using the *ZERO*, numeric and ENTER keys.

The stock levels entered must only be the additions to the stock level. Thus, if 2,5 tonnes of stock are left, and additional stock of 5 tonnes is purchased, then 5 tonnes should be entered. The system will automatically add the original 2,5 tonnes to provide a new balance of 7,5 tonnes.

If absolute stock levels are to be entered, as with opening balances, the *ZERO* key should be pressed before entering the actual stock level.

NOTE: The updating of stock levels is key-switch protected, therefor, before a stock level can be changed, the front panel key-switch should be switched to the **CAL** position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).

EXAMPLE:

COMMAND: To update the stock level for product #3, first display the stock level of product #3 by entering the command sequence:

TOTAL TARGET 3 ENTER

DISPLAY: The stock level of product #3 will be displayed as:

<ident>=<stock level>

WHERE:

* *<ident>* is the product identifier which identifies the product for which the stock level is being displayed. The *<ident>* display will alternate between **"STOCK"** and the assigned name of product #3.
* *<stock level>* is the current stock level for the product indicated by *<ident>*.

ACTION: Switch the front panel key-switch to the *CAL* position (*see Front Panel Key-switch in the PAN-section of the Systems Manual*).

OPTION 1: To update the stock level - enter the new stock amount to be added using the numeric and ENTER keys. After the new stock level has been entered, the display should indicate the new stock level which will be the sum total of the old balance and the newly entered amount.

OPTION 2: To enter an opening balance - press the *ZERO* key. The display should now indicate a zero amount. Enter the opening stock balance using the numeric keys followed by the *ENTER* key. The display should now indicate the correct opening balance.

TABLE OF CONTENTS

Reporting Facilities

1 Introduction

The function of the reporting facilities, is to report on all of the activities of the system. The reporting is done, both on a continuous basis, and at preselected intervals. By studying the generated reports, you are able to follow the activities of the system.

The reporting facilities consist of the following:

* Management Reporting (Totalisers & Stock Levels)
* Activity Reporting (Alarms & System Activities)

2 Printer Setup

The printer setup, consists of three separate actions, which may be summarised as follows:

* Connecting the printer via the serial printer port.
* Programming the printer setpoints.
* Programming the printer ports.

To connect a printer to the serial port of the ***Route*** controller, please refer to the serial port connection diagrams in the systems manual.

The programming of the printer setpoints is covered as a separate topic hereafter.

The programming of the printer ports, are covered in under *Programming the Serial Ports* in the CNF-section earlier in this manual.

3 Printer Setpoints

The printer setpoints define the parameters of the printing functions and are programmed in the same manner as all other setpoint functions as described under *Setpoint Programming* in the CNF-section earlier in this manual.

The command sequence for the programming of the printer setpoints is:

PRINT SETP ENTER

Parameters that are defined by the programming of the printer setpoints include:

* Automatic Reporting Times
* Printer Page Sizes
* Print Style Select Codes

* Multi-drop Channel Numbers

A list of the available printer setpoints is provided in **TABLE REP-1** below.

After the programming of the printer setpoints has been completed, their actual values should be recorded in the space provided for reference at a later stage.

3.1 TABLE: PRINT SETP ENTER

NO	DISPLAY	UNIT/RANGE	VALUE	DESCRIPTION
1	Shift 1	Hours/0..23		Shift 1 Start
2	Shift 2	Hours/0..23, 25		Shift 2 Start
3	Shift 3	Hours/0..23, 25		Shift 3 Start
4	1st Day	Days/1..31		First Day of Month
5	1st Mnth	Months/1..12		First Month of Year
6	BtchCntr	Level/0..9		Batch Counter Level
7	Enable	0..65535		Report Enable Flag
8	PageLgth	Lines		Print Lines/Page
9	PageWdth	Columns/20..250		Print Columns/Page
10	InitCode	Printer Code		Printer Initialise
11	PrntCode	Printer Code		Report Print Style
12	AlrmCode	Printer Code		Alarm Print Style
13	Channel	Channel/1..255		Multi-Drop Channel

TABLE REP-1: A list of setpoints which defines the parameters of the management reporting facilities.

3.2 Printer Setpoint Definitions

3.2.1 (*Shift 1*) - Start Time

The *Shift 1* setpoint defines the start time of shift 1 and end time of shift 3.

The time specified by the *Shift 1* setpoint is assumed to be the time at which the shift 3, daily, weekly, monthly and yearly reports will be generated and printed and their totalisers will be cleared.

The *Shift 1* setpoint is entered as hours in the range of 0..23 and it have no default value.

NOTE: If an hour outside the valid range is specified, then the automatic shift 3, daily, monthly and yearly reports will not be generated, in addition, their totalisers will not be cleared.

3.2.2 (*Shift 2*) - Start Time

The *Shift 2* setpoint defines the start time of shift 2 and end time of shift 1.

The time specified by the *Shift 2* setpoint is assumed to be the time at which the shift 1 report will be generated and printed and its totalisers cleared.

This *Shift 2* setpoint is entered as hours in the range of 0..23 and it have no default value.

NOTE: If an hour outside the valid range is specified, then the automatic shift 1 report will not be generated, in addition, their totalisers will not be cleared

3.2.3 (*Shift 3*) - Start Time

The *Shift 3* setpoint defines the start time of shift 3 and end time of shift 2.

The time specified by the *Shift 3* setpoint is assumed to be the time at which the shift 2 report will be generated and printed and its totalisers cleared.

This *Shift 3* setpoint is entered as hours in the range of 0..23 and it have no default value.

NOTE: If an hour outside the valid range is specified, then the automatic shift 2 reports will not be generated, in addition, their totalisers will not be cleared

3.2.4 (*1st Day*) - Of Month

The *1st Day* setpoint defines the starting date of a new month.

The date specified by the *1st Day* setpoint is assumed to be the date on which the monthly report will be generated and printed and its totalisers cleared. The hour at which the daily report is generated is specified by the *Shift 1* setpoint.

This *1st Day* setpoint is entered as a date in the range 1..31 and it have no default value.

NOTE: If a date outside the valid range is specified then the automatic monthly and yearly reports will not be generated, in addition, their totalisers will not be cleared

3.2.5 (*1st Mnth*) - Of Year

The *1st Month* setpoint defines the month within which a new year starts.

The month specified by this setpoint is assumed to be the month within which the yearly report

will be generated and printed and its totalisers cleared. The date on which and hour at which the yearly report is generated is specified by the *Shift 1* and *1st Day* setpoints respectively.

The *1st Month* setpoint is entered as a month in the range of 1..12 and it have no default value.

NOTE: If a month outside the valid range is specified, then the yearly report will not be generated, in addition, their totalisers will not be cleared.

3.2.6 (*BtchCntr*) - Batch Counter Level

The *Batch Counter* setpoint defines the totaliser level which batch counter should be used as the batch counter for the *Batch/Recipe* reports.

NOTE: As this setpoints use an offset of 0 instead of 1 as indicated under level in **TABLE REP-2** below, the value that should be entered for this setpoint should always be one less than indicated by the level in the table.

EXAMPLE: To count the batches by day, the level of which is 6 as indicated in **TABLE REP-2** below, the *Batch Counter* setpoint should be set to 6-1 = 5.

3.2.7 (*Enable*) - Reports Flag

The *Enable* setpoint defines the reports that are required to be activated at the fixed times defined by the printer setpoints.

NOTE: By excluding an automatic report from the print list, it prevents that report from being generated automatically, but does not prevent its totalisers from being cleared.

Each of the automatic reports available has been assigned a numerical code as indicated in **TABLE REP-2** below. The *Enable* setpoint is formed by the numerical sum total of the codes for which automatic reports are required.

The value of the *Enable* setpoint may be calculated either by:

* starting with **0** and **adding** the value of the codes for which automatic reporting **is** required,
* starting with **65535** and **subtracting** the value of the codes for which automatic reporting **is not** required.

NO	REPORT	CODE	DESCRIPTION
1	Total	1	Total Consumption (Manual Only)
2	Batch/Recipe	2	Last Batch/Recipe Report
3	Group/Batch	4	Last Group/Batch Report

NO	REPORT	CODE	DESCRIPTION
4	Hourly	8	Last/Current Hour Report
5	Shift	16	Last/Current Shift 1, 2 or 3
6	Daily	32	Last/Current Day Report
7	Weekly	64	Last/Current Week Report
8	Monthly	128	Last/Current Month Report
9	Yearly	256	Last/Current Year Report
10	Setup	512	Target/Recipe Changes Reporting
11	Calibration	1024	Calibration Changes Reporting
12	Alarm Report	2048	Alarm Reporting
13	Stock Report	4096	Daily Material Stock Level Reporting
14	Recipe Report	8192	Daily Recipe Production Report
15	New Page/Shift	16384	New Page with Turn of A Shift
16	New Page/Day	32768	New Page with Turn of A Day

TABLE REP-2: *A list of reporting functions indicating their print enable codes and a brief description thereof.*

NOTE: All totalisers will be cleared automatically at the end of it's live as defined by the printer setpoints, provided that the printing option has been installed in the software. The automatic reports being excluded from the report list do not affect the clearing of totalisers.

EXAMPLE:

If the following automatic reports are required, then the value of the *Enable* setpoint can be calculated as follows.

```
Recipe    2 +
Batch     4 +
Daily    64
----------
=        70  should be entered as the print enable code.
----------
```

3.2.8 (*PageLgth*) - Print Lines/Page

The *Page Length* setpoint defines the page length requirements to be able to perform the skip perforation function and enable the page headings.

The *Page Length* setpoint value is constructed by two values which together forms the page length definition. These two values are as indicated below.

* **Page Size** - Page Length in Lines
* **Print Size** - Printable Lines/Page

The value of the *Page Length* setpoint is calculated by the following formula:

*Page Size * 256 (Constant) + Print Size*

When the page length is defined by the printer, the *Page Size* part of the setpoint may be defined as 0, and only the *Printable Lines/Page* need be specified. When the *Page Size* parameter is 0, then the standard *Top of Form* code will be sent to the printer when the last print line of the page is reached.

NOTE: When the value of the *Page Length* setpoints is set to zero, the perforation will not be skipped and the headings won't be printed. This may be used for printing on continuous paper rolls.

EXAMPLE: If a *Page Size* of 50 is required with a *Print Size* of 45 lines, then the value of the *Page Length* setpoint may be calculated as follows:

*50 * 256 + 45 = 12845*

3.2.9 (*PageWdth*) - Print Columns/Page

The *Page Width* setpoint defines the width of a print line in printable columns. The *Page Width* setpoint allows the system to do automatic wraparound printing and print reformatting to suit the available print line width.

The value that is needed for the *Page Width* setpoint depends on the print style selection and the physical width of the print paper in use.

With normal 10-CPI (*Characters/Inch*) print styles, the value of the *Page Width* setpoint should be set to either 80 when 80 column printers are used, and 132 when 132 column printers are used.

When condensed printing is used, which utilises a 16-CPI character size, the value of the *Page Width* setpoint should be set to 128 when 80 column printers are used, and 211 when 132 column printers are used.

The valid range of this setpoint is in the range of 20 to 250 characters with a default of 80 if the value is set outside these limits.

3.2.10 (*InitCode*) - Printer Initialize

The *Printer Initialize Code* setpoint is constructed by a two-character code sequence that allows the system to reset and set the top of form of the printer.

NOTE: The printer code to be used for initializing the printer does not form part of the ***Route*** specification, but is a function of the printer in use. The values used for the calculation of the *Printer Initialize Code* setpoint should be obtained from the printer manual which is supplied along with the printer.

The ***Route*** controller transmits the *Print Initialization Code* when a printer on-line code is received, or when the top of a new page is reached. When switching the printer on-line or when switching the printer on, the printer normally transmits an on-line code (code 19) which is detected by the ***Route*** controller, which will then reset its line counter to be in sync with the printer. When printer initialization is not required, the value of this setpoint may be set to zero.

NOTE: The ***Route*** controller relies on the Epson compatible on-line and off-line codes transmitted by the printer, which is Codes 17 and 19 respectively, for detecting the on-line or off-line state of the printer.

The value of the *Printer Initialize Code* is calculated, by using the printer codes obtained from the printer manual, as follows:

*Second Code * 256 (Constant) + First Code*

EXAMPLE:

Assume your printer's initialization code as obtained from its manual is:

ESC @
27 64 (decimal)
1B 40 (hex)

then the value of the *Printer Initialization Code* is calculated as follows:

*(64 * 256) + 27 = 16411*

3.2.11 (*PrntCode*) - Report Print Style

The *Print Code* setpoint is used to select the print style which should be used for normal printing.

The print style for normal printing may be selected from any of the print styles available on the printer in use, for example, condensed, elite, double width, italics, etc.

NOTE: The printer code used to select the print style for normal printing is a function of the

printer in use. The values to be used in the calculation of the *Print Code* setpoint have to be obtained from the printer manual which is supplied along with the printer.

The *Print Code* setpoint is transmitted at the beginning of each print line of the management reports. If no special print style is required, then the value of the *Print Code* setpoint may be set to zero.

The value of the *Print Code* setpoint is calculated, by using the printer codes obtained from the printer manual, as follows:

*Second Code * 256 (Constant) + First Code*

EXAMPLE:

Assume your printer's code for condensed printing as obtained from its manual is:

ESC	SO
27	15 (decimal)
1B	0F (hex)

then the value of the *Print Code* setpoint is calculated as follows:

*(15 * 256) + 27 = 3867*

3.2.12 (*AlrmCode*) - Alarm Print Style

The *Alarm Code* setpoint is used to select the print styles that should be used when an alarm is printed.

The print style for alarms may be selected from any of the print styles available on the printer in use, for example, condensed, elite, double width, italics, etc.

NOTE: The printer code used to select the print style for alarm printing is a function of the printer in use. The values to be used in the calculation of the *Alarm Code* setpoint have to be obtained from the printer manual which is supplied along with the printer.

The *Alarm Code* setpoint is transmitted at the beginning of each print line when alarm reports are generated. If no special print style selection is required, the value of this setpoint may be set to zero.

The value of the *Alarm Code* setpoint is calculated, by using the printer codes obtained from the printer manual, as follows:

*Second Code * 256 (Constant) + First Code*

EXAMPLE:

Assume your printer's code for double width printing (as for all Epson printers), is:

ESC	*SI*
27	*14 (decimal)*
1B	*0E (hex)*

then the value of the *Alarm Code* setpoint is calculated as follows:

*(14 * 256) + 27 = 3611*

3.2.13 (*Channel*) - Multi-drop Address

The *Channel* setpoint defines the station address when a multi-drop communication network is used.

Each controller within a multi-drop communication network has to be assigned an address, by which it will be addressed when information is required from it. This address assigned to each station should correspond with that defined within the master station.

The valid range of the station address is between 1 and 255, but also depends on the limitations of the master station.

When the ***Route*** controller acts as a master station within a multi-drop communications network, then a value of 256 should be added to its own station address to identify it as the master. Even when a ***Route*** is a master within one network, it may also be a slave within a second network.

NOTE: Only one master station may exist within a multi-drop communications network.

4 Printer Variables

The printer variables hold some of the calculated parameters which results from the reporting activities.

These variables may be useful to follow and verify the reporting functions.

The printer variables currently available are summarised in **TABLE REP-3** below which also includes a brief description of each of the variables.

4.1 TABLE: TEST 4 ENTER

NO	DISPLAY	UNIT/RANGE	DESCRIPTION
1	AutoFlag		Flags for Auto Reports
2	Man Flag		Flags for Manual Reports
3	LastS/H		Last Hour and Shift Reported
4	LineCntr		Printer Line Counter
5	Head/Rep		Last Reporting Level and Heading Flag

TABLE REP-3: A list of printer variables indicating their function.

4.2 Printer Variable Definitions

4.2.1 (*AutoFlag*) - Auto Reporting Flag

The *Auto Flag* variable is used to mark the outstanding automatic management reports to be printed. These flags are set by the *Auto Report Generator*, as defined by the printer setpoints, and cleared when the reports have been completed by the *Print Generator*.

The value of the *Auto Flag* variable is constructed in exactly the same way as the *Enable* setpoint described earlier under *Printer Setpoints* in this section.

When the *Auto Report Generator* requires a report to be generated, the value of the report's enable code is added to the value already within the *Auto Flag* register.

The *Print Generator* examines the *Auto Flag* register to determine which reports are required. When the print enable code of a report has not been included in the *Enable* setpoint, only its totalisers will be cleared. When a report's enable code has been included in the *Enable* setpoint, its report will be generated before its totalisers are cleared. When all functions related to a report has been completed, its report flag will be removed from the *Auto Flag* register.

By examining the *Auto Flag* register you will be able to determine which reports have been requested by the *Auto Report Generator* but has not yet been processed by the *Print Generator*.

4.2.2 (*Man Flag*) - Manual Reporting Flag

The *Manual Flag* variable is used to mark the outstanding manually requested management reports to be printed. These flags are set when a management report is manually requested via the keyboard (*see Manual Reports later in this section*).

The value of the *Manual Flag* variable is constructed in exactly the same way as the *Enable* setpoint described earlier under *Printer Setpoints* in this section.

When a management report is requested via the keyboard, the value of the report's enable code

is added to the value already within the *Manual Flag* register.

The *Print Generator* examines the *Manual Flag* register to determine which reports are required. When a report's flag is set within the *Manual Flag* register, its report will be generated after which its flag will be removed from the *Manual Flag* register.

By examining the *Manual Flag* register you will be able to determine which reports have been requested via the keyboard but has not yet been processed by the *Print Generator.*

4.2.3 (*LastS/H*) - Last Shift Hour Report

The *Last Hour/Shift* register holds the values for the last hour and shift for which auto reports have been generated by the *Auto Report Generator.*

The value of the *Last Hour/Shift* register is calculated according to the following formula:

*Value = (Hour * 256) + Shift*

By applying this formula in reverse, you are able to determine the last hour and shift for which reports have been generated.

The value of the last hour is only valid during the first minute after the turn of an hour. After this, its value is set to 25. This is done to guarantee an hourly report at the turn of each hour.

The value of the last shift is set to 1, 2 or 3, depending for which shift the last shift reports was generated. The value of the last shift is only updated with the turn of an hour which coincides with the turn of a shift.

4.2.4 (*LineCntr*) - Line Counter

The *Line Counter* register keeps track of the number of lines that have been printed.

Each time the value of the *Line Counter* register either equals or exceeds the number of printable lines per page, as set by the *Page Length* setpoint, the printer is advanced to the next top of the next page and the *Printer Initialize* setpoint is transmitted. The heading flag is also set at this point to request a new heading from the *Print Generator.*

When the printer transmits the on-line code, the value of which is 19, the *Line Counter* register is reset to zero and the heading flag is set to synchronize the *Line Counter* with the printer.

4.2.5 (*Head/Rep*) - Heading/Last Report

The *Heading/Last Report* register holds both the *Heading Request Flag* for the *Print Generator* and the value of the last generated report.

The value of the *Heading/Last Report* register is calculated according to the following formula:

*Value = (Last Report * 256) + Heading*

The *Heading Request Flag* is set to one by the *Report Page Format* controller when new headings are required. After the heading has been generated, the *Print Generator* resets the *Heading Request Flag.*

The *Last Report* flag is set to keep track of the sequence of reports. This allows proper control over the grouping of similar reports and the generation of inter-page headings and underlining.

5 Management Reporting

The purposes of the management reports are to report on the following:

* Material consumption
* Material Stock levels.

The management reporting is done on predefined levels which are summarized in **TABLE REP-4** below. A brief description of each report, whether it can be generated automatically or not, and the access level for manual requesting of reports is also included.

LEVEL	REPORT	DESCRIPTION	AUTO
1	TOTAL	Total Material Consumption	NO
2	BATCH	Material Consumption for Last Batch	YES
3	GROUP	Material Consumption for Group of Batches	YES
4	HOUR	Material Consumption for Last Hour	YES
5	SHIFT	Material Consumption for Last Shift	YES
6	DAILY	Material Consumption for Last Day	YES
7	WEEKLY	Material Consumption for Last Week	YES
8	MONTH	Material Consumption for Last Month	YES
9	YEARLY	Material Consumption for Last Year	YES
TOTAL	STOCK	Material Overall Stock Balance	YES

TABLE REP-4: A list of available management reports indicating their manual access level key and automatic report availability.

Each of the reporting levels between levels 4 and 9 have predefined times/dates at which the reports will be activated. The times and dates are defined by the printer setpoints.

The management reports at levels 2 and 3 is activated by the control function and depends on its requirements.

A manual access level key has been assigned to each level is indicated in **TABLE REP-4** above. This access level key is used in conjunction with the *PRINT* key to issue a manual request for the management report. These access level keys corresponds to those which apply to the display of the totalisers.

Unlike the automatic reporting function, the manual reports at all levels can be requested without affecting the totalisers.

Each of the generated reports, will generally be of similar format as set out in the example below:

DATE	TIME	CHANNEL	REPORT	BATCH	M	Prd01	Prd02	TOTAL
03Sep92	10:51:00	1	Batch	23	A	30.00	50.00	80.00
03Sep92	10:54:00	1	Batch	24	A	30.00	50.00	80.00
03Sep92	10:54:00	1	Group	24	A	720.00	1200.00	1920.00

WHERE:

* **DATE** is the date on which the report was generated
* **TIME** is the time at which the report was generated
* **CHANNEL** identifies the source of the report, in the case of multi-channel systems
* **REPORT** identifies the type of report that was generated
* **BATCH** indicates the sequential batch number or the number of batches that was completed for a reporting period
* **M** indicated the way in which the report was generated, either Automatic or Manually. This is also an indication of whether the associated totalisers were cleared or not since totalisers are only cleared with automatically generated reports
* **Prd01/Prd02** indicates the product name/code for which the material consumption has been totalised. During the initial system setup, a product name/code is assigned to each product. This enables the system to use the specified product names/code in the report heading.
* **TOTAL** is the cross total of the material consumption for all products. This indicates the total batch size that was produced.

This format of the management report may however change depending on the requirements of the system.

5.1 Manual Reports

The format of the command sequence to manually request a management report has been defined as:

PRINT [<*level*>] ENTER

WHERE:

* *<level>* is the manual access level key which has been assigned to each of the management reports. The access level keys are as indicated in **TABLE REP-4** above.
* **[]** indicate optional parameters. If omitted, an access level of 0 is assumed which will generate the automatic report based on the *TOTAL* totaliser after which the totalisers of the *TOTAL* level will be cleared.

Unless an error has been detected in the command sequence entered, the system will respond with the message:

Report Active !

EXAMPLE:

To manually request the daily report of which the access level key is 6, the command sequence should be entered as:

PRINT 6 ENTER

The system will thereafter respond with the message:

Report Active !

and print the daily report as requested. All the other management reports can be manually requested in the same way.

NOTE: If the *TOTAL* key is entered as the access level key, then the stock balance report will be printed. If an excess level key of 0 is specified, or the access level key is omitted, then the *TOTAL* report will be generated and the *TOTAL* level totaliser cleared.

5.2 Automatic Reports

The automatic reporting facility automatically generates management reports at a predefined times and dates, after which the totaliser of the respective level of reporting will be cleared.

The *TOTAL* report can only be requested by the operator. The generation of the *BATCH* and *GROUP* reports are controlled by the control function. The other reports are generated automatically at times and on dates as specified by the *Printer Setpoints*.

The totalisers of the respective levels are cleared automatically after the report has been generated, irrespective of whether the reporting level has been included or excluded from the *Enable* setpoint.

5.3 Report Definitions

5.3.1 Total Report

The *TOTAL* management report is generated only upon manual request via the keyboard.

There are two ways in which the *TOTAL* management report may be requested, either with or without clearing of the associated totalisers.

To generate the *TOTAL* management report without clearing of the associated totalisers, the manual access level key of the *Total* level should be specified is indicated in the command sequence below.

PRINT 1 ENTER

To generate the *TOTAL* management report with clearing of the associated totalisers, the manual access level key of the *Total* level should be omitted as indicated in the command sequence below.

PRINT ENTER

An "A" or an "M" under the M-heading will indicate whether the associated totaliser has been cleared or not. An "A" indicates that the totalisers have been cleared after the report was generated.

5.3.2 Batch/Recipe Report

The *Batch/Recipe* management report is generated automatically after a batch/recipe has been completed, after which its totalisers will be cleared. This is controlled by the control function of the system.

The *Batch/Recipe* management report can be requested manually at any time by issuing the command:

PRINT 2 ENTER

By manually requesting the *Batch/Recipe* management report does not affect its totalisers.

5.3.3 Group/Batch Report

The *Group/Batch* management report is generated automatically after a *Group of Batches* or *Batch of Recipes* has been completed after which its totalisers will be cleared. This is controlled by the control function of the system.

The *Group/Batch* management report can be requested manually at any time by issuing the command:

PRINT 3 ENTER

By manually requesting the *Group/Batch* management report does not affect its totalisers.

5.3.4 Hourly Report

The *Hourly* report will be generated automatically at the turn of each hour after which its totalisers will be cleared.

The *Hourly* report can be requested manually requested at any time by issuing the command:

PRINT 4 ENTER

By manually requesting the *Hourly* management report does not affect its totalisers.

5.3.5 Shift Report

The *Shift* management report will be generated automatically at the end of each shift after which its totalisers will be cleared.

The hour at which the shifts start is defined by the *Shift Start Time* printer setpoints. Up to a maximum of three shifts may be defined by means of the *Printer Setpoints*. If only two shifts are required, the *Shift 3* time may be set to 25 to disable the third shift.

The *Shift* management report can be requested manually at any time by issuing the command:

PRINT 5 ENTER

By manually requesting the *Shift* management report does not affect its totalisers.

5.3.6 Daily Report

The *Daily* management report will be generated automatically at the end of the day after which its totalisers will be cleared.

The hour at which a day starts is defined by the *Shift 1* printer setpoint.

The *Daily* management report can be requested manually at any time by issuing the command:

PRINT 6 ENTER

By manually requesting the *Daily* management report does not affect its totalisers.

5.3.7 Weekly Report

The *Weekly* management report will be generated automatically at the end of the week, together

with the *Daily* management report, after which its totalisers will be cleared.

The day of the week on which a week starts is defined to be day one as determined by the setting of the real time clock. The day of the week is set when setting the real time clock. Since the day of the week of the real time clock does not specifically relate to any real day, day one should be set to coincide with the day on which the weekly report is required.

The *Weekly* management report can be requested manually at any time by issuing the command:

PRINT 7 ENTER

By manually requesting the *Weekly* management report does not affect its totalisers.

5.3.8 Monthly Report

The *Monthly* management report will be generated automatically at the end of each month, together with the *Daily* management report, after which its totaliser will be cleared.

The day on which a month start is specified by the *1st Day* printer setpoint.

The *Monthly* management report can be requested manually at any time by issuing the command:

PRINT 8 ENTER

By manually requesting the *Monthly* management report does not affect its totalisers.

5.3.9 Yearly Report

The *Yearly* management report will be generated automatically at the end of each year, together with the *Daily* management report, after which its totalisers will be cleared.

The month within which a new year starts is specified by the *1st Month* printer setpoint.

The *Yearly* management report can be manually requested at any time by issuing the command:

PRINT 9 ENTER

By manually requesting the *Yearly* management report does not affect its totalisers.

5.3.10 Stock Balance Report

The *Stock* balance management report is generated automatically at the end of each day, together with the *Daily* management report.

The *Stock* balance management report may be requested manually at any time by issuing the

command:

PRINT TOTAL ENTER

By manually requesting the *Stock* balance management report does not affect its totalisers.

5.3.11 Recipe Summaries (Batching Controllers Only)

Recipe Summaries is printed along with the daily reports to provide a summary of the recipes produced for the previous day.

Information provided by this report includes the number of batches of each recipe produced and the amount of material consumed by each recipe.

6 Activity Reporting

The activity reports provide for reporting on topics such as:

* Calibration Functions
* Setpoint Lists
* Target/Recipe Setup
* Target/Recipe Selection
* Programmed Recipes Reports
* System Alarms

6.1 Calibration

The Calibration Reports is generated automatically each time a calibration function is performed. This report is purely informative and may be disabled if not required.

6.2 Setpoint Lists

The *Setpoint List* report generates a list of the values of all the setpoints on demand. This forms an easy tracking for record purposes, of all the values of the setpoints.

The *Setpoints List* report can only be requested manually. This is done with the command:

SETPT PRINT ENTER

6.3 Target/Recipe Setup

The *Target/recipe Setup* report will be generated each time the target value is changed or a new recipe is selected or modified.

This *Target Setup* report can be requested manually at any time by issuing the command:

TARGET PRINT ENTER

With recipe and order-based systems, this report will print a list of all programmed recipes/orders.

TABLE OF CONTENTS

1 Preface

This section contains a discussion of the testing facilities available for the *Route Series Controllers*. These testing facilities may be used for testing the software and hardware of the *Route Series Controller*. A detailed explanation of each of the testing functions available is included.

2 Introduction

The test facilities available for the Route Series Controllers provide for testing of both the hardware and the application software of the system.

Each test facility has been assigned a test identifier. The test identifier identifies the test to be performed. This also allows for various test functions to be performed through the TEST key.

The general format of the TEST command is:

TEST [[[<*id*>]<*chan*>]<*ofs*>] ENTER

WHERE:

* <***id***> is the test identifier which has been assigned to test function required. The test identifier has to be specified in order to access the required test facility. If the test to be performed is not identified, then test 0 will be assumed. If however, a channel or offset needs to be specified, they have to be leaded by a test identifier. This is true even for the default test which is 0.
* <***chan***> is the number of the channel (ie. Loadcell #1, Loadcell #2, etc.) on which the required test is to be performed. If the channel is not identified, then channel 1 will be assumed. If however an offset has to be specified, then a channel number must be entered first. This is true even for the default channel which is channel 1.
* <*ofs*> if the offset into a list of variables. The offset is only valid for test functions which involves the display of test variables.

The available test facilities of the Route Series Controller are listed in *TABLE TST-1*. This table identifies the test identification and channel numbers involved (*where applicable*) for each test function. Each test facility will be discussed in full detail in the sections to follow.

ID	CHAN	TEST FUNCTION
0	NONE	Application Variables
1	AIN	Analog Input Variables
2	NONE	Timer, Date & Time
3	NONE	Modbus Holding Registers

ID	CHAN	TEST FUNCTION
4	NONE	Printer Variables
5	NONE	Front Panel Display Test
6	I/O	I/O Channel Reassignment
7	AOU	Analog O/P Test
8	DOU	Digital O/P Test
9	DIN	Digital I/Ps Test
PRINT	COM	Communications Test

TABLE TST-1: Test facilities of the Route Series Controller.

3 Presetting Variables

A facility is provided to manually modify the values of any of the variables being displayed. This is required in view of simulating certain conditions.

As for the setpoint functions, once the value of a variable is being displayed, it may be modified. This is done by simply typing in the required value for the variable being displayed, followed by the *ENTER* key.

NOTE: Since the processor has the first right to the test register values, it may reset the value of the register to it's original (or any other) value.

As for the setpoint values, the keys which are used to manipulate the values of the test variables are:

* The **NEXT** and **ENTER** keys are used to move on to the next variable in the list.
* The **PREV** and **DELETE** keys are used to revert back to the previous variable in the list.
* The numeric keys **0 to 9** are used to enter new values for the variable being displayed.
* The **ENTER** key after entry of a numerical value is used to assign the entered value to the variable.
* The **CANCEL** key after entry of a numerical value is used to cancel the entered value and retain the original value.
* The **DELETE** key after entry of a numerical value is used to delete the last entered digit of the value being entered.
* The **CANCEL** key on its own is used to terminate the variable display facility.

4 TEST 0 ENTER: Application Variables

The *TEST 0* function is used for examination of the Application Variables which are discussed

under *Application Variables* in the **APL**-section of the *Applications Manual*.

5 TEST 1 ENTER: Analog Input Variables

The *TEST 1* function is used for the examination of the Analog Input Variables which are discussed under *Calibration Variables* in the **CAL**-section of this manual.

6 TEST 2 ENTER: Timer, Real Time Clock

The *TEST 2* function is used to examine the operation of the system timer, the conversion rate and the real time clock. *TABLE TST-2* below provides a list of the variables that may be examined by the *TEST 2* function.

The format of the command sequence defined for the *TEST 2* is as follows:

TEST 2[<*no*>] ENTER

WHERE:

* <*no*> is the number of the variable which is to be examined. If the number of the variable is not specified, then variable 1 is assumed.

NO	DISPLAY	UNIT/RANGE	DESCRIPTION
1	MstrTimr	0.1 second	The master timer which may amongst other be used to test the accuracy of the internal timers and to timing external events.
2	DiffTime	0.1 second	Program cycle time.
3	ResoCnts	Pulses/Sec	Timing pulses per second. This register is calibrated by comparison to the real time clock.
4	DiffCnts	Pulses/Cycle	Timing pulses per program cycle.
5	Conv/Sec	0.1 Conv/Sec	A/D Conversions/second
6	LastTime	0.1 second	Last timer reading. This value should not be altered...!!!
7	LastCntr	Pulses	Last timing pulse reading. This value should not be altered...!!!
8	Sec /mS	Real Time	Sec = <*value*> DIV 256 mS = <*value*> MOD 256
9	Hr/Min	Real Time	Hr = <*value*> DIV 256 Min = <*value*> MOD 256

NO	DISPLAY	UNIT/RANGE	DESCRIPTION
10	DD/WD	Real Time	Date = <*value*> DIV 256 Week Day = <*value*> MOD 256
11	YY/MM	Real Time	Year = <*value*> DIV 256 Month = <*value*> MOD 256

TABLE TST-2: A list of TEST 2 Variables.

7 TEST 3 ENTER: Modbus Registers

The *TEST 3* function is used for the examination of the *MODBUS* registers. The complete set of modbus registers are described under *Modbus Registers* in the ***MOD-section*** of this manual. If any nonstandard *MODBUS* registers have been defined for a specific application, these will be described under *Modbus Registers* in the ***APL-section*** of the *Applications Manual.*

8 TEST 4 ENTER: Printer Variables

The *TEST 4* function is used for the examination of the *Printer Variables* which are discussed under *Printer Variables* in the **REP**-section of this manual.

9 TEST 5 ENTER: Display Test

The *TEST 5* function is used to verify the operation of the LCD display. The general format of the command to test the display is as follows:

TEST 5 ENTER

The display test function will perform the following tests:

* Testing of all the character positions of the display.
* Testing of the function LEDs.
* Testing of the keyboard BUZZER.

When performing the display test function, the system performs the following actions, each for a duration of 1 second:

* The display is blanked.
* The display is filled with all 1s, 2s 3s...9s.
* Finally, all the display segments are lit.
* With each of these functions' one of the front panel LEDs will be lit, starting from the left and proceeding towards the right.
* Each time the display is changed, the keyboard BUZZER will beep for 250 milliseconds.

10 TEST 6 ENTER: I/O Allocation

10.1 Preface

The ***Route*** series controllers provide you with a facility to reassign the I/O functions, thereby changing the physical I/O which is associated with each logical I/O function.

For the purpose of I/O reassignment, we have to clearly distinguish the difference between physical and logical I/Os.

A physical input or output is the actual hardware which is used to interface to external devices for which status monitoring is required or which is to be controlled. The physical inputs and outputs are numbered according to the order in which they are located within the system. They normally range from 1 to the last available input or output.

A logical input or output is the software programmed function or definition which is monitored or controlled by the software. The logical input and output functions are number in a logical order from 1 to the last defined input of output function. Each logical input or output has a predefined function and definition which are assigned to it.

The number of inputs and outputs which are made available for reassignment is defined by the software of the ***Route*** controller.

With I/O reassignment, the link between the software programmed functions (logical inputs and outputs) and the available physical inputs and outputs are completed.

10.2 Introduction

The I/O reassignment tables are stored within the calibration *RAM* of the system and are protected against corruption by a 16-bit CRC checksum. If at any stage this checksum fails, the system will disable the reassignment table and connect the physical I/O's to the logical functions in a chronicle order, that is, physical output 1 is connected to logical output function 1, physical output 2 is connected to logical output function 2, etc.

There are two basic forms of I/O reassignment:

* With the first form of I/O assignment, which is the default, each physical I/O is assigned to a logical programmed function in a chronicle order. In this case, physical I/O 1 is assigned to the programmed function 1, physical I/O 2 is assigned to the programmed function 2, etc. This is accomplished by calling up the appropriate reassignment function and pressing the *CANCEL* key in response to the reassignment request.
* With the second form of I/O assignment the physical I/Os are assigned to the logical I/O functions in a free format.

Both forms of I/O assignment are explained in full detail hereafter for each of the I/O assignment

functions.

The I/O reassignment function has its requirement under the following circumstances:

* When the number of software functions defined exceeds the number of available I/O's. In this case the user may decide which of the logical I/O functions are required as physical I/Os and which physical I/O will be assigned to each of these functions.
* The number of physical I/Os exceeds the number of logical I/O functions, in which case the spare physical I/Os may be used as a backup in the event of failure.

The I/O reassignment function makes provision for all types of I/O's to be reassigned. The types of I/Os are analog inputs (which includes the loadcell channels), analog outputs, digital inputs and digital outputs.

For the purpose of I/O reassignment, each I/O type has been assigned an I/O type identifier. The I/O type identifiers are summarised in *TABLE TST-3* below.

The general format of the command sequence for the I/O reassignment functions is given below:

TEST 6<*type*> ENTER

WHERE:
* <***type***> is the I/O type as defined in *TABLE TST-3* below.

All the I/O reassignment functions are performed in a similar fashion. With each of these functions you are presented with a logical I/O function, and are required to assign a physical I/O to that function. There are no restrictions on the assignment of the I/Os, and the onus is on the assignee of the I/Os to ensure proper assignment of the I/Os.

The only limitation placed on the assignment of I/Os is that the output which is assigned to a logical I/O function must at least exist to the knowledge of the system. The maximum number of I/Os which may be used for reassignment is fixed within the software according to the maximum number of I/Os required to successfully implement the software.

During I/O reassignment, the following keys are used:

* The **ENTER** key is used to advance to the next logical I/O function.
* The **DELETE** key is used to revert to the previous logical I/O function.
* The numeric keys **0** to **9** are used to directly select the required physical I/O which is to be assigned to a logical function.
* The **NEXT** and **PREV** keys are used to scroll through the available physical I/Os.
* The **CANCEL** key is used to terminate the I/O assignment function.
* The '=' key is used to reverse the state (normally closed/open) of a physical I/O.
* The '**SPACE**' key is used to *DISABLE* a logical output function or switch off a logical input function.

After the I/O assignment has been completed, the system requests for access to the calibration *RAM* to store the I/O assignment table. If access to the calibration *RAM* is denied, by pressing the *CANCEL* key during the access request, the assignment table will be stored and the previous assignment will stay intact. A new assignment will only take effect after it has been stored in the calibration *RAM* to ensure save operation of the system during the reassignment.

NOTE: The *CANCEL* key is used for cancellation of the assignment table. When the *CANCEL* key is pressed at any stage during the I/O assignment function, the assignment function will be cancelled after which access to the calibration *RAM* is requested in order to cancel the existing reassignment table. If the intention is not to disable a previous assignment, the *CANCEL* key must be pressed again in response to this request.

TYPE	I/O Type Description
1	Analog Inputs
7	Analog Outputs
8	Digital Outputs
9	Digital Inputs

TABLE TST-3: I/O Reassignment TYPE identifiers.

10.3 Analog Input Reassignment

A list of the logical analog inputs, which may all be reassigned, is given in *TABLE APL-5* under *Analog Inputs* in the *APL-section* of the *Applications Manual*.

WARNING: Although a single physical analog input may be assigned to more than one logical analog input function, this may interfere with the proper functioning of the analog input concerned.

10.3.1 Analog Input Reassignment Procedure

STEP 1: Enter the command sequence required for the reassignment of analog inputs.

TEST 61 ENTER

STEP 2: I/O Assignment.

DISPLAY: The system responds by displaying the first logical analog input that may be assigned to a physical analog input.

LAIN 1 = PAIN 1

NOTE: During the first assignment or after a previous I/O assignment cancellation, the

physical analog inputs will be presented in a chronicle order, which is also the default when reassignment is not used. This may be altered depending on the requirements.

ACTION:

OPTION 1: If you wish to cancel a previous assignment of the analog inputs, press the *CANCEL* key, in which case the system will advance to *STEP 3*.

OPTION 2: Use the *NEXT* and *PREV* keys to select the required physical analog input which is to be assigned to the displayed logical analog input function.

OPTION 3: You may directly select the required physical analog input to be assigned to the logical analog input function by entering the number of the analog input required by means of the numeric keys.

OPTION 4: Press the *ENTER* key to advance to the next logical analog input function to be assigned a physical analog input. When the *ENTER* key is pressed after assignment of the last logical analog input function, the system will advance to *STEP 3*.

OPTION 5: Press the *DELETE* key to revert to the previous logical analog input function to be assigned a physical analog input.

STEP 3: Storing/Cancelling the assignment table.

DISPLAY: Access to the calibration *RAM* is requested to either store the new assignment table, or to cancel the currently stored assignment table if the *CANCEL* key was pressed in *STEP 2*.

Switch to Cal !

ACTION:

OPTION 1: Press the *CANCEL* key to deny the system access to the calibration *RAM* thereby leaving the currently stored analog input assignment table intact.

OPTION 2: Switch the front panel key-switch to the *CAL* position to allow the system to either store the new assignment table or cancel the currently stored assignment table.

This concludes the analog input assignment function.

10.4 Analog Output Reassignment

A list of the logical analog outputs, which may all be reassigned, is given in *TABLE APL-6* under *Analog Outputs* in the *APL-section* of the *Applications Manual*.

WARNING: Although a single physical analog output may be assigned to more than one logical analog output function, this may interfere with the proper functioning of the analog output concerned. The last logical analog output function evaluated by the system will take priority when the analog output in question is to be controlled.

10.4.1 Analog Output Reassignment Procedure

STEP 1: Enter the command sequence required for the reassignment of analog outputs.

TEST 67 ENTER

STEP 2: I/O Assignment.

DISPLAY: The system responds by displaying the first logical analog output that may be assigned to a physical analog output.

LAOU 1 = PAOU 1

NOTE: During the first assignment or after a previous I/O assignment cancellation, the physical analog outputs will be presented in a chronicle order, which is also the default when reassignment is not used. This may be altered depending on the requirements.

ACTION:

OPTION 1: If you wish to cancel a previous assignment of the analog outputs, press the *CANCEL* key, in which case the system will advance to *STEP 3*.

OPTION 2: Use the *NEXT* and *PREV* keys to select the required physical analog output which is to be assigned to the displayed logical analog output function.

OPTION 3: You may directly select the required physical analog output to be assigned to the logical analog output function by entering the number of the analog output required by means of the numeric keys.

OPTION 4: Press the *ENTER* key to advance to the next logical analog output function to be assigned a physical analog output. When the *ENTER* key is pressed after assignment of the last logical analog output function, the system will advance to *STEP 3*.

OPTION 5: Press the *DELETE* key to revert to the previous logical analog output function to be assigned a physical analog output.

STEP 3: Storing/Cancelling the assignment table.

DISPLAY: Access to the calibration *RAM* is requested to either store the new assignment table, or to cancel the currently stored assignment table if the *CANCEL* key was pressed in *STEP 2.*

Switch to Cal !

ACTION:

OPTION 1: Press the *CANCEL* key to deny the system access to the calibration *RAM* thereby leaving the currently stored analog output assignment table intact.

OPTION 2: Switch the front panel key-switch to the *CAL* position to allow the system to either store the new assignment table or cancel the currently stored assignment table.

This concludes the analog output assignment function.

10.5 Digital Input Reassignment

A list of the logical digital inputs, which may all be reassigned, is given in *TABLE APL-7*under *Digital Inputs* in the *APL-section* of the *Applications Manual*.

WARNING: Although a single physical digital input may be assigned to more than one logical digital input function, this may interfere with the proper functioning of the digital input concerned. This will cause more than one logical digital input function to be switched by a single physical digital input.

10.5.1 Digital Input Reassignment Procedure

STEP 1: Enter the command sequence required for the reassignment of digital inputs.

TEST 69 ENTER

STEP 2: I/O Assignment.

DISPLAY: The system responds by displaying the first logical digital input that may be assigned to a physical digital input.

LDIP 1 = PDIP 1

NOTE: During the first assignment or after a previous I/O assignment cancellation, the physical digital inputs will be presented in a chronicle order, which is also the default when reassignment is not used. This may be altered depending on the requirements.

ACTION:

OPTION 1: If you wish to cancel a previous assignment of the digital inputs, press the *CANCEL* key, in which case the system will advance to *STEP 3*.

OPTION 2: Use the *NEXT* and *PREV* keys to select the required physical digital input which is to be assigned to the displayed logical digital input function.

OPTION 3: You may directly select the required physical digital input to be assigned to the logical digital input function by entering the number of the digital input required by means of the numeric keys.

OPTION 4: Press the '=' key to reverse the state (change the digital input from normally open to normally close) of the logical digital input function concerned.

OPTION 5: Press the '*SPACE*' key to disable the logical digital input function, thereby switching it *OFF* permanently. The logical digital input function may also be switched to a permanent high state by pressing the *NEXT* key after the *SPACE* key.

OPTION 5: Press the *ENTER* key to advance to the next logical digital input function to be assigned a physical digital input. When the *ENTER* key is pressed after assignment of the last logical digital input function, the system will advance to *STEP 3*.

OPTION 6: Press the *DELETE* key to revert to the previous logical digital input function to be assigned a physical digital input.

STEP 3: Storing/Cancelling the assignment table.

DISPLAY: Access to the calibration *RAM* is requested to either store the new assignment table, or to cancel the currently stored assignment table if the *CANCEL* key was pressed in *STEP 2*.

Switch to Cal !

ACTION:

OPTION 1: Press the *CANCEL* key to deny the system access to the calibration *RAM* thereby leaving the currently stored digital input assignment table intact.

OPTION 2: Switch the front panel key-switch to the *CAL* position to allow the system to either store the new assignment table or cancel the currently stored assignment table.

This concludes the digital input assignment function.

10.6 Digital Output Reassignment

A list of the logical digital outputs, which may all be reassigned, is given in *TABLE APL-8* under *Digital Outputs* in the *APL-section* of the *Applications Manual*.

WARNING: Although a single physical digital output may be assigned to more than one logical digital output function, this may interfere with the proper functioning of the digital output concerned. The last logical digital output function evaluated by the system will take priority when the digital output in question is to be switched.

10.6.1 Digital Output Reassignment Procedure

STEP 1: Enter the command sequence required for the reassignment of digital outputs.

TEST 68 ENTER

STEP 2: I/O Assignment.

DISPLAY: The system responds by displaying the first logical digital output that may be assigned to a physical digital output.

LDOP 1 = PDOP 1

NOTE: During the first assignment or after a previous I/O assignment cancellation, the physical digital outputs will be presented in a chronicle order, which is also the default when reassignment is not used. This may be altered depending on the requirements.

ACTION:

OPTION 1: If you wish to cancel a previous assignment of the digital outputs, press the *CANCEL* key, in which case the system will advance to *STEP 3*.

OPTION 2: Use the *NEXT* and *PREV* keys to select the required physical digital output which is to be assigned to the displayed logical digital output function.

OPTION 3: You may directly select the required physical digital output to be assigned to the logical digital output function by entering the number of the digital output required by means of the numeric keys.

OPTION 4: Press the '=' key to reverse the state (change the digital output from normally open to normally close) of the logical digital output function concerned.

OPTION 5: Press the '*SPACE*' key to disable the logical digital output function, thereby causing it not to switch any physical digital output.

OPTION 5: Press the *ENTER* key to advance to the next logical digital output function to be assigned a physical digital output. When the *ENTER* key is pressed after assignment of the last logical digital output function, the system will advance to *STEP 3*.

OPTION 6: Press the *DELETE* key to revert to the previous logical digital output function to be assigned a physical digital output.

STEP 3: Storing/Cancelling the assignment table.

DISPLAY: Access to the calibration *RAM* is requested to either store the new assignment table, or to cancel the currently stored assignment table if the *CANCEL* key was pressed in *STEP 2*.

Switch to Cal !

ACTION:

OPTION 1: Press the *CANCEL* key to deny the system access to the calibration *RAM* thereby leaving the currently stored digital output assignment table intact.

OPTION 2: Switch the front panel key-switch to the *CAL* position to allow the system to either store the new assignment table or cancel the currently stored assignment table.

This concludes the digital output assignment function.

11 TEST 7 ENTER: Analog O/Ps

The *TEST 7* function is used to test and calibrate the analog outputs. This function allows you to preset an analog output to any value.

The general format of the command sequence for the analog output testing/calibration is as follows:

TEST 7[*ZERO/SPAN*][<*chan*>] ENTER

WHERE:

* *<chan>* is the channel number of the analog output which needs to be tested. The channel numbers are defined in *TABLE APL-6* under *Analog Outputs* in the *APL-section* of the *Applications Manual*. If *<chan>* is omitted, channel one will be assumed.
* When the ***ZERO*** key is specified, a zero calibration of the analog output can be performed.
* When the ***SPAN*** key is specified, a span calibration of the analog output can be performed.

NOTE: Detailed descriptions of the analog output calibration features are given under *Analog Output Calibration* in the *CAL-section* of this manual and will not be discussed any further in this section.

During the testing of the analog outputs, the following actions may be performed:

* With the front panel key-switch in the **AUTO** position it is possible to monitor the normal operation of the analog output. The key depressions that are valid in this mode are summarised below:

    * The **ENTER** and **NEXT** keys are used to advance to and monitor the next analog output.
    * The **DELETE** and **PREV** keys are used to revert back and monitor the previous analog output.
    * The **CANCEL** key is used to cancel the analog output test function.

* With the front panel key-switch in the **CAL** position, the current output value is latched in after which it may be altered as follows:

    * The **ENTER** key is used to force the output to its maximum output value of 100% which may represent either 20mA or 10V depending on requirements.
    * The **DELETE** key is used to force the output to its minimum output value of 0% which will represent either 0V or 4mA depending on requirements.
    * The **NEXT** key is used to increase the output value by 10%.
    * The **PREV** key is used to decrease the output value by 10%.
    * The *Numeric keys*, **0** to **9**, are used to directly enter an output value between 0 and 100%.

12 TEST 8 ENTER: Digital O/Ps

The testing of the digital outputs can be done in any one of the following ways:

* Manual override of the outputs
* Software override of the outputs

In both cases, the status of each individual output can be set.

NOTE: During the testing of the digital O/Ps, both manual and software override, all of the outputs will be latched, that is, they are unavailable for normal use by the unit. Therefor special care should be taken when using these test facilities, not to upset the normal switching of valves, gates, etc.

12.1 Manual Override

The manual override facility of the digital O/Ps, although not part of the keyboard test facility, is discussed here, since it forms an integral part of the proper testing of the outputs, should a problem arise.

The manual override facility of the digital O/Ps is provided to enable the following functions:

* To preset the output statuses for certain stages of the control process, such as during the cleaning cycle.
* To test the condition of the output stages when doing maintenance.

The manual override test facility of the digital O/Ps is activated by simply switching the front panel key-switch on the keyboard to the *MANUAL* position which will activate the dip switches of the digital O/P section. In this state, the status of the digital O/Ps depends on the setting of the dip switches (*see Digital Outputs in the SYS-section of the Systems Manual*). With the front panel key-switch in the *MANUAL* position, each digital O/P may be switched on or off by simply switching the corresponding switch of the dip switch.

In addition to the provision for testing of the digital outputs, the manual output switching facility provides for the programming of certain predefined output statuses for use during for example cleaning cycles. Once the dip switches have been set to a predefined state, they may be left in that position. The predefined state is activated by simply switching the front panel key-switch to the *MANUAL* position.

12.2 Software Override

The software test facility of the digital O/Ps is provided to verify proper system control over the digital O/Ps. The software test facility forms an integral part of the complete testing of the digital O/Ps.

The software test facility of the digital O/Ps consists of two basic functions which are listed below:

* Monitoring the operation of the digital O/Ps whilst under processor control is obtained with the front panel key-switch in the *AUTO* position.
* Overriding the operation of the digital O/Ps whilst under processor control is obtained by switching the front panel key-switch to the *CAL* position.

NOTE: When the software override test facility is activated, the digital O/Ps under test will be

latched in their current states and the processor will loose control over these digital O/Ps. The digital O/Ps under test will be switched on command from the keyboard only.

The digital output test facility can be activated from the keyboard at any stage during the control process. Care should however be taken not to interfere with the normal functioning of the system.

The general format of the command sequence to test the digital O/Ps is given below:

TEST 8[<*set*>] ENTER

WHERE:

* <*set*> is the digital O/P set which is to be tested or monitored. Each set of outputs consists of eight digital outputs. If <*set*> is omitted, then the default value which is channel #1, will be assumed.

During the testing of digital O/Ps the following keys may be used:

* With the front panel key-switch in the *AUTO* position the uses of the keys are defined as indicated below:
  * The **ENTER, NEXT, PREV, DELETE** ('←') and **0 to 8** keys to select the output set which is to be tested.

* With the front panel key-switch in the *CAL* position the uses of the keys are defined as indicated below:
  * The **ENTER** key to change the status of the digital OP which is highlighted by the cursor.
  * The **NEXT, PREV, DELETE** ('←') and **0 to 8** keys to select the required digital output which is to be tested.

* The **CANCEL** key to terminate the function for testing of outputs.

EXAMPLE: To activate the testing of the digital OP set one, which is the default, enter the command sequence:

TEST 8 ENTER

The system response will be as follows:

DOU 1 = 00000000

WHERE:

* "*00000000*" is the current status of the output set selected. The leftmost "*0*" corresponds to digital output 1 of the set and the rightmost "*0*" corresponds to digital output 8 of the set. A "*0*" indicates an inactive output, and a "*1*" indicates an active output.

At this stage the status of a specific output can be changed as follows:

* Switching the front panel key-switch to the *CAL* position.
* Use the *NEXT* and *PREV* keys to select the output to be switched.
* Press the *ENTER* key to change the status of the selected output.

13 TEST 9 ENTER: Digital I/Ps

The test facility of the digital outputs allows two basic functions to be performed on the digital inputs which are:

* With the key-switch in the *AUTO* position, the switching of the digital inputs can be monitored.
* With the key-switch in the *CAL* position, the switching of the digital inputs can be simulated allowing the software functions to be tested.

The test function of the digital inputs may be activated at any stage during the control process. Care should however be taken not to upset the control process.

The general format of the command sequence to activate the digital input test facility is as follows:

TEST 9[<*set*>] ENTER

WHERE:

* <*set*> is the digital input set which is to be tested. Each set of digital inputs contains 8 digital inputs. If the digital input set is omitted, input set 1 is assumed.

During the testing of digital inputs, the following keys may be used:

* With the front panel key-switch in the *AUTO* position the uses of the keys are defined as indicated below:
  * The **ENTER, NEXT, PREV, DELETE** ('←') and **0 to 8** keys to select the digital input set which is to be tested.

* With the front panel key-switch in the *CAL* position the uses of the keys are defined as indicated below:
  * The **ENTER** key to simulate a change in the status of the digital input which is highlighted by the cursor.
  * The **NEXT, PREV, DELETE** ('←') and **0 to 8** keys to select the required digital output which is to be tested.

* The **CANCEL** key to terminate the function for testing of outputs.

EXAMPLE: To establish the correct functioning of the digital inputs, enter the command

sequence:

TEST 9 ENTER

The system response will be as follows:

DIN 1 = 00000000

WHERE:

* *"00000000"* is the current status of the digital inputs of the selected set of inputs. The leftmost "*0*" corresponds to digital input 1 of the selected set, and the rightmost "*0*" corresponds to digital input 8 of the selected set. A "*0*" indicates an inactive input and a "*1*" indicates an active input.

14 TEST PRINT ENTER; Communications

The testing of the communications channels is provided to allow the communications activities to be monitored.

There are two functions which may be used for the testing of communications which are:

* Communications monitoring.
* Receive and transmit buffer display function.

14.1 Communications Monitoring

The general format of the command sequence for the monitoring of the communications is as follows:

TEST PRINT[<*chan*>] ENTER

WHERE:

* <*chan*> is the communications channel which is to be monitored. The channel normally ranges between 1 and 4. This may vary depending on the number of communications channels that are installed. If no channel is omitted then channel #1 will be assumed.

EXAMPLE: Communications channels 1 and 2 may be interrogated with the following two commands respectively:

TEST PRINT ENTER (Channel #1)
TEST PRINT 2 ENTER (Channel #2)

The registers which may be monitored with the aid of the communications test facility are summarized in *TABLE TST-4* below. Included in the table is a brief description of each of the registers.

NO	DISPLAY	UNIT/RANGE	DESCRIPTION
1	COM 1: 1	0..255	Number of received characters
2	COM 1: 2	0.1 sec	Receive timer
3	COM 1: 3	0..255	Last character received
4	COM 1: 4	0..255	Number of characters to transmit
5	COM 1: 5	0.1 sec	Transmit timer
6	COM 1: 6	0..255	Last character transmitted

TABLE TST-4: Communications testing variables.

NOTE: The complete receive and transmit buffers may be viewed by following the guidelines set out below:

* View the last character transmitted/received.
* Switch the front panel key switch to the *CAL* position.
* Press the *DELETE* ("←") key to reset the current view position to the last character received or transmitted.
* Press the *PREV* key to scan the buffer backwards. With each depression of the *PREV key*, the view position will become -1, -2, -3, ...-255, 0, etc.
* Press the *NEXT* key to scan the buffer forward. With each depression of the *NEXT key*, the view position will become -255, -254, -253, ...-1, 0, etc.
* Press the *DELETE* ("←") key to restore the view position to the last received character which is view position 0.

14.2 Transmit/Receive Buffer Display

This test function allows the display of the receive and transmit buffers in a printable character format.

The general format of the command sequence to display the transmit/receive buffers of the communications channels is as follows:

PRINT TEST <*chan*> ENTER

WHERE:

* <*chan*> is the communications channel which is to be monitored. The channel normally ranges between 1 and 4. This may vary depending on the number of communications channels that are installed. If channel is omitted then channel #1 will be assumed.

The display for this test function has been formatted as indicated below:

<Rx/Tx>: ABCDEFGHIJKL

WHERE:

* *<Rx/Tx>* indicates which of the Rx or Tx buffers are viewed.
* *ABCDEFGHIJKL* is the last 12 characters in the communications buffer.

For the purpose of this test the following keys have been assigned the functions as indicated below.

* With the front panel key-switch selected for *AUTO* mode, the following keys may be used as indicated:
  * Use the *NEXT*, *PREV*, *ENTER* and *DELETE* ("←") keys to switch between the receive and transmit buffers.
  * Use the *CANCEL* key to terminate the communications buffer display function.

* With the front panel key-switch selected for *CAL* mode, the following keys may be used as indicated:
  * Use the *DELETE* ("←") key which to reset the current view position to the last received/transmitted character.
  * Use the *PREV* key to scan the buffer backwards. With each depression of the *PREV key*, the view position will become -1, -2, -3, ...-255, 0, etc.
  * Use the *NEXT* key to scan the buffer forward. With each depression of the *NEXT key*, the view position will become -255, -254, -253, ...-1, 0, etc.
  * Use the *DELETE* ("←") key to restore the view position to the last received character which is view position 0.

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1 Preface

The section contains a discussion of the Alarm, Warning and Reply messages generated by the *Route Series Controllers*. A detailed explanation of each of the messages and the conditions under which they are generated is included.

Although all of these messages are not used in all applications, they are listed here for to provide a list of all available messages.

2 Introduction

During the course of operation, the system may detect certain conditions which require the attention of the plant operator or engineer. These conditions may be either be alarm conditions, which may prevent the system from performing its normal control functions, or control conditions where the system awaits external conditions to be satisfied before it can resume its control function.

Conditions detected by the systems are announced through a set of predefined system messages. The system messages may be issued either as an alarm or a control message depending on the conditions under which the message is issued. Alarm messages are characterized by the presence of an asterisk "*" which is appended to the end of the message. Control messages are characterized by the presence of the exclamation mark "!" which is appended to the end of the message.

Whenever an alarm is present, the front panel *ALARM LED* will be lit and the control status symbol, the two characters in the rightmost positions of the top display line, will flash. Where an external alarm output has been provided for, the alarm output will be switched on when an alarm is present.

TABLE MES-1 below provides a list of the available messages followed by an explanation of the conditions under which to the messages will be issued.

3 TABLE: System Messages

NO	MESSAGE	DESCRIPTION
1	Add Test Mass	Less Than 10% Calibration Mass
2	Batch Aborted	Batch Dump/Abort DIP Active
3	Batch Complete	Batch Completed Normally
4	Command Error	Error in Command Function
5	Comms Failure	Communications Failure

NO	MESSAGE	DESCRIPTION
6	Control Error	Error in Control Function
7	Defined Message	Application Defined Message
8	Flow Error	Material No Flowing Properly
9	Flow Failure	Material Fail to Flow in Time
10	Invalid Channel	Invalid Channel Specified
11	Invalid Command	Invalid Command Issued
12	Invalid Message	Invalid Message Request Detected
13	Invalid Password	Invalid Password Issued
14	Invalid Port	Invalid Serial Port Specified
15	Invalid Range	Invalid Parameter Range Detected
16	Invalid Report	Invalid Report Requested
17	Invalid Target	Invalid Target Requested
18	Invalid Total	Invalid Total Requested
19	LC ADC Error	LC A/D Converter Error
20	LC ADC Failure	LC A/D Converter Failure
21	LC ADC Overload	LC A/D Input Overload
22	LC INT Error	LC A/D Interrupt Error
23	Linear Disable	Linearity Function Disabled
24	Linear Enable	Linearity Function Enabled
25	Linear Recorded	Requested Linearity Point Recorded
26	Manual Override	Front Panel Key-switch MANUAL
27	Mode Range	Invalid Control Mode Detected
28	Port Setup	Serial Port Setup Completed
29	Power Failure	Power Failure Detected
30	Report Active	Requested Report Activated
31	RTC Error	Real Time Clock Error Detected

NO	MESSAGE	DESCRIPTION
32	Select Target	No Target Has Been Selected
33	Setup Complete	System Setup Completed
34	Setup Error	System Setup Error Detected
35	Setup System	System Setup Required
36	Span Adjusted	Span Calibration Adjusted
37	Span Range	Request Test Mass below 10%
38	Span Recorded	Span Calibration Recorded
39	System Busy	System Still Busy (Wait for Ready)
40	System Halted	Absence of The RUN/INT* Interlock
41	Target Adjusted	Target Setpoint Adjusted
42	Target Complete	Target Batches Completed
43	Target Entered	Target Setpoint Entered
44	Target Error	Target Check Error Detected
45	Target Select	New Target Selected
46	Timer Error	Internal Timer Error
47	Timer Failure	Internal Timer Failure
48	Total Cleared	Totals Cleared on Request
49	Zero Adjusted	Zero Calibration Adjusted
50	Zero Out of Range	Zero Mass Out of Range
51	Zero Recorded	Zero Calibration Recorded
52	Batch Size Exc.	Permissible Batch Size Exceeded
53	Comms Error	Communications Error
54	Emergency Stop	Emergency Stop Activated
55	Extra Aborted	Extrapolation Cancelled
56	Extra Disabled	Extrapolation Disabled
57	Extra Enabled	Extrapolation Enabled

NO	MESSAGE	DESCRIPTION
58	LC ADC Time Out	LC A/D Converter Time Out

TABLE MES-1: A list of available system messages.

4 Message Definitions

4.1 Add Test Mass

The *Add Test Mass* message is issued during span calibrations when an attempt is made to perform a span calibration with test masses of which the total mass is less than the allowed minimum of 10% of the full span range of the loadcells in use.

Increase the amount of mass used for span calibrations.

4.2 Batch Aborted

The *Batch Aborted* message is issued after a *Batch Dump Request* has been issued,

The *Batch Dump Request* is normally an external signal which is interfaced to the system via the *Batch Dump* digital input.

For more information refers to the *Digital Inputs* in the *APL-section* in the *Applications Manual*.

4.3 Batch Completed

The *Batch Completed* message is issued after the successful completion of a selected number of batches.

The currently selected batches may be reactivated or a new set of batches may be selected and activated for further batching.

For more information refers to *Target Selection* in the *TRG-section* of the *Applications Manual* and the *Start Request* under *Digital Inputs* in the *APL-section* of the *Applications Manual*.

4.4 Command Error

The *Command Error* message is issued when a program error has been detected during the execution of a specific keyboard command function.

Although this error might sometimes be reported during power up, it normally points to an error in the definition of the requested command.

If this message is issued during the normal operation of the system, this should be reported stating

the following: the software version, the command executed and the conditions under which this error was reported.

4.5 Comms Failure

The *Comms Failure* message is issued when the system fails to establish communications with other devices.

Check the communications setup and cabling to all devices.

4.6 Control Error

The *Control Error* message is issued when a program error has been detected in the control function.

Although this message may sometimes be reported during power up, it normally points to an improper definition of the control function which may result in improper execution of the control function.

If this message is issued during the normal operation of the system, this should be reported stating the following: the software version, the status symbol and the conditions under which this error occurred.

4.7 Defined Message

The *Defined Message* is a dummy message which allows the control function to define further messages to assist the operator with the proper operation of the system.

Although this message may sometimes be reported during power up, it will normally be replaced with a control defined message.

If this message is reported during the normal operation of the system, this should be reported stating the following: the software version, the status symbol and the conditions under which this message was reported.

4.8 Flow Error

The *Flow Failure* message is issued when a material flow problem is detected.

The flow characteristics of the material are defined by the stability parameters during the initial system setup.

For more information refers to the *Calibration Setpoints* in the *CAL-section* of this manual.

4.9 Flow Failure

The *Flow Failure* message is issued when the maximum time allowed to fill the weigh flask has been exceeded.

The maximum fill time is available as a setpoint.

For more information refers to the *Application Setpoints* in the *APL-section* of the *Applications Manual*.

4.10 Invalid Channel

The *Invalid Channel* message is issued when referenced is made to a nonexistent channel number during a command request.

Verify the format of the entered command.

4.11 Invalid Command

The *Invalid Command* message is issued when the format of the requested command does not match any of the available command definitions.

Refer to the required function for the correct command format.

4.12 Invalid Message

The *Invalid Message* message is issued when an attempt is made to issue a nonexistent message.

Although this message may be issued during power up, it normally means improper definition of request to the messages.

If this message is reported during the normal operation of the system, this should be reported stating the following: the software version together with the conditions under which this message was issued.

4.13 Invalid Password

The *Invalid Password* message is issued when the entered password does not match the password expected by the system.

Verify the password with the plant supervisor.

4.14 Invalid Port

The *Invalid Port* message is issued when reference is made to a nonexistent communications port

during a command function.

Verify the command format of the function required.

4.15 Invalid Range

The *Invalid Range* message is issued when the value specified does not fall within the range expected by the requested function.

Verify the parameters of the function required.

4.16 Invalid Report

The *Invalid Report* message is issued when the referenced are made to a nonexistent report.

Verify the available reports and format of the function required.

4.17 Invalid Target

The *Invalid Target* message is issued when the requested target number does not exist, or has not been defined.

Verify the format of the function required and the available targets.

4.18 Invalid Total

The *Invalid Total* message is issued when the reference is made to nonexistent totalisers.

This message may be reported either as a result of a command function, or as a result of a request by the system to update totalisers.

Although this message may sometimes be reported during power up, it normally indicates improper functioning of the system totalisers.

If a command function concerning totalisers was attempted when this message appeared, verify the format of the command function.

Verify the proper setup of the system, referring to *Initial System Setup* in the *TRG-section* of the *Applications Manual*. If the problem still persists, it should be reported stating the following: the software version and the conditions under which this message was issued.

4.19 LC ADC Error

The *LC ADC Error* message is issued when an error has been detected in the information returned by the A/D converter of the loadcell channels.

Although this message may sometimes be reported during power up, it normally means improper operation of the loadcell A/D converter and should be reported to the instrumentation department.

4.20 LC ADC Failure

The *LC ADC Failure* message is issued when the A/D converter of any of the loadcell channels failed to return a value after three conversions.

Although this message may sometimes be reported during power up, it is normally reported as a result of the failure of the loadcell A/D converter, and should be reported to the instrumentation department.

4.21 LC ADC Overload

The *LC ADC Overload* message is issued when the input to the loadcell channel's A/D converter causes an overload condition.

Although this message may appear during power up, it is normally reported as a result of an overload condition which may be caused by any of the following: loadcell overloading, loadcell failure or broken wires in the loadcell connections.

Check the mV signals from each of the loadcells as well as all connections that have been made in the loadcell line.

4.22 LC INT Error

The *LC INT Error* message is reported when the information received by the loadcell channels A/D converted is invalid.

Although this message may sometimes be reported during power up, it is normally as a result of the improper functioning of the loadcell's A/D converter and should be reported to the instrumentation department.

4.23 Linear Disable

The *Linear Disable* message is issued after a request has been received to disable the linearisation function.

For more information, refer to *Linearisation* in the *CAL-section* of this manual.

4.24 Linear Enable

The *Linear Enable* message is issued after a request has been received to enable the linearisation function.

For more information, refer to *Linearisation* in the *CAL-section* of this manual.

4.25 Linear Recorded

The *Linear Recorded* message is issued after a request has been received to record a point on the linearisation curve during linearisation.
For more information, refer to *Linearisation* in the *CAL-section* of this manual.

4.26 Manual Override

The *Manual Override* message is issued after the front panel key-switch has been switched to the *MAN* position.

Where provision has been made for external *Manual* selection, this message may also be reported when the external *Manual Selection* is activated.

4.27 Mode Range

The *Mode Range* message is issued when the reported control mode is nonexistent in the control function.

Although this message may sometimes be reported during power up, it is normally as a result of the improper definition of the control function and should be reported stating the following: the software version and the conditions under which this message was issued.

4.28 Port Setup

The *Port Setup* message is issued after the setup of a communication port has been successfully completed.

4.29 Power Failure

The *Power Failure* message is reported each time a hardware reset has been received.

This message is always reported during power up. If this message is reported during the normal operation of the system, it may be as a result of power dips or excessive program cycle times.

If this message persists during the normal operation of the system, this should be reported stating the following: the software version and the conditions under which this message were issued.

4.30 Report Active

The *Report Active* message is issued after a print function has been requested to indicate that the system has processed the requested report.

4.31 RTC Error

The *RTC Error* message is issued when the date and/or time reported by the real time clock is invalid.

This may be as a result of the failure or improper setup of the real time clock. If this message persists during the normal operation of the system, check the programming of the real time clock.

4.32 Select Target

The *Select Target* message is issued when the system requires a target value to be programmed before the requested function can be executed.

Select or verify the targets. For more information, refer to *Target Selection* in the ***TRG-section*** of the *Applications Manual*.

4.33 Setup Complete

The *Setup Complete* message is issued after the successful completion of the system setup.

4.34 Setup Error

The *Setup Error* message is issued when an error or checksum error has been detected in the setup information of the system.

Verify the system setup. For more information refers to *Initial System Setup* in the ***TRG-section*** of the *Applications Manual*.

4.35 Setup System

The *Setup System* message is issued when an error or checksum error has been detected in the setup information of the system.

Verify the system setup. For more information refers to *Initial System Setup* in the ***TRG-section*** of the *Applications Manual*.

4.36 Span Adjusted

The *Span Adjusted* message is issued after a span calibration has been successfully completed.

4.37 Span Range

The *Span Range* message is issued when the value of the specified test mass is not within the allowable range.

Verify the size of the test mass used for calibrations and the value entered during the calibration.

4.38 Span Recorded

The *Span Recorded* message is issued when a request for a span calibration has been successfully completed.

4.39 System Busy

The *System Busy* message is issued when the requested function requires the system to be inactive during the execution of the command.

Wait for the system to complete the control function before repeating the request for this command.

4.40 System Halted

The *System Halted* message is issued when the system receives an *Emergency Stop Request.*

The *Emergency Stop Request* is normally interfaced to the system via a digital input

For more information, refer to the *Digital Inputs* in the *APL-section* of the *Applications Manual.*

4.41 Target Adjusted

The *Target Adjusted* message is issued after the successful adjustment to the selected target.

4.42 Target Complete

The *Target Complete* message is issued when the system has successfully completed the selected target.

The system may be restarted using the same target or a new target may be selected for processing.

4.43 Target Entered

The *Target Entered* message is issued when a new target has been programmed and entered into the system.

4.44 Target Error

The *Target Error* message is issued when the system detects an error in either the parameters or the checksum of the selected target.

Re-select or reenter the target and check the parameters of the target.

4.45 Target Select

The *Target Select* message is issued when one of the preprogrammed targets has been successfully selected.

4.46 Timer Error

The *Timer Error* message is issued when the system detects an error in the operation of the internal master timer.

Normally these errors are corrected by the system, however, if this error persists during the normal operation of the system, this should be reported stating the following: the software version and conditions under which the error is reported.

4.47 Timer Failure

The *Timer Failure* message is issued when the system detects a failure of the master timer of the system.

Reboot the system by removing the power for +- 10 seconds, and reapply the power. If this condition still persists, report this to the instrumentation department.

4.48 Total Cleared

The *Total Cleared* message is issued after a request has been received to reset some or all of the system totalisers.

4.49 Zero Adjusted

The *Zero Adjusted* message is issued after a request has been received for adjustment of the zero setting.

4.50 Zero Out of Range

The *Zero Out of Range* message is issued when an attempt is made to adjust the zero level of the weigh flask which will cause the *zero offset* to exceed its limits.

For more information, refer to *Zero Range* under *Calibration Setpoints* in the *CAL-section* of this manual.

4.51 Zero Recorded

The *Zero Recorded* message is issued after a successful adjustment to the zero setting of the weigh flask.

4.52 Batch Size Exceeded

The *Batch Size Exceed* message is issued when the total mass programmed for the target is in excess of the maximum allowed

For more information refers to *Maximum Mass* under *Initial System Setup* in the *TRG-section* of the *Applications Manual.*

4.53 Comms Error

The *Comms Error* message is issued when errors are present in the communications with other devices.

Verify the correct setup and connections of the serial communications ports.

4.54 Emergency Stop

The *Emergency Stop* message is issued when the system has detected an active *Emergency Stop Request.*

The *Emergency Stop Request* is normally interfaced to the system via a digital input. For more information, refer to *Digital Inputs* in the *APL-section* of the *Applications Manual.*

4.55 Extra Aborted

The *Extra Aborted* message is issued when an abort or cancel request has been received during the execution of the extrapolation function.

4.56 Extra Disabled

The *Extra Disabled* message is issued when a request to disable the extrapolation function has been received.

4.57 Extra Enabled

The *Extra Enabled* message is issued when a request to enable the extrapolation function has been received.

4.58 LC ADC Time Out

The *LC ADC Time Out* message is issued when the loadcell analog input channel fails to return a new reading within the maximum allowable time.

This message normally points to improper functioning of the loadcell channel and should be reported to the maintenance department.