

RCA15

Rack Mounted Amplifier/Digitiser



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User Manual

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Chapter 1 Introduction to RCA15	2
Figure 1.1 RCA15 (RL2) Local Display/Programmer	2
Chapter 2 Installing and Connecting the RCA15	4
Environmental Approvals	4
Environmental Requirements	5
Terminal Connections	5
Chapter 3 The RCA15 Controls and Configurable Parameters	8
Configurable Parameters	9
Chapter 4 Strain Gauge Input to the RCA15	10
The Strain Gauge Input	10
Hardware Configuration:	10
Auto Calibration	11
Display Averaging (dA)	11
Display Averaging with Peak Hold	12
Input Filtering	12
Chapter 5 Analogue Outputs	13
Calibration	14
Chapter 6 Relay Output Module	15
General Description	15
Module Functions	15
Set Points (SP)	15
In Flight Compensation	15
Hysteresis (HYS)	15
Output Action (OA)	16
Latching Outputs	16
Chapter 7 The Communications Port	17
RC1 Communications Connections - Current 1 Loop	17
RC3 (RS232/485) Communication Connections	18
Serial Communication Protocol	19
Fast MANTRABUS Format - selected when CP is 128	19
Operation	20
Updating	20
Communications Commands	20
Command 1 Request for all data:	20
Command 2 Request Display Data	21
Response To Command 2 From RCA15	21
Commands 3 To 18: Write data to RCA15 Parameter	21
Response To Command 3 to 22	22
Command 19: EEPROM ENABLE / DISABLE	22
COMMAND 20: Output Relay Reset	22
Command 21: Auto Tare	23
Command 22: Peak Hold Reset	23
ASCII Format - selected when CP is 129	23
Instruction Set for ASCII Serial Communications	24
RCA15 Printer Format	25
Chapter 8 Trouble Shooting Guide	27
Chapter 9 RCA15 Specifications	28
DC Analogue Outputs	28
Control / Alarm Relay Output	28
The Communications Port Data	29
Data Retention and Protection	29
Environmental	29
Physical	29
Power Supplies	29
RCA15 Order Codes	30
Instrument Setup Record Sheet	31
W A R R A N T Y	31

Chapter 1 Introduction to RCA15

The In Line Intelligent Strain Gauge Amplifier RCA15 is a compact Rack Mounted microprocessor based module specifically designed to control weighing applications. Its flexibility of design allows for the connection of most Strain Gauges, pressure or strain gauges over a wide range of sensitivity. Two versions offer local or remote Display/Programming facility.

Basic modules offer the following facilities:-

A simple auto calibration of the highest and lowest weights required, an easy auto tare setting and peak hold facility. A password facility gives protection to setup parameters. DC analogue outputs of 4-20mA and 0-10V are standard with full scaling over any desired range and the ability to invert these outputs if required.

Gain sensitivity is selectable via DIL switches between 0.5 and 200mV/V.

Several 'plug in' options are available. An optional relay output module provides for 2 set points and hysteresis can be applied to both set points together with In Flight compensation. Relays can be inverted and latched. All these facilities being set digitally in real engineering terms from the plug in programmer unit or from front panel display module. Both relay and analogue outputs have a high level of isolation. Optional communications modules provide for 20mA noise immune current loop, RS232 or RS485 connections to a PC, PLC or main frame. This allows for the input variable to be viewed and any setup parameters changed.

Multiple 20mA RCA15s can be connected via an IF25 current loop to RS232 interface which, when included, allows for an expansion of up to 250 RCA15 modules. The RS232 port is available for Time/Data or data only printers to be used, logging all desired activities.

Baud speeds between 300 and 19200 are programmable. The power supply module is available for 220/240V AC and 110/120V AC

Figure 1.1 RCA15 (RL2) Local Display/Programmer

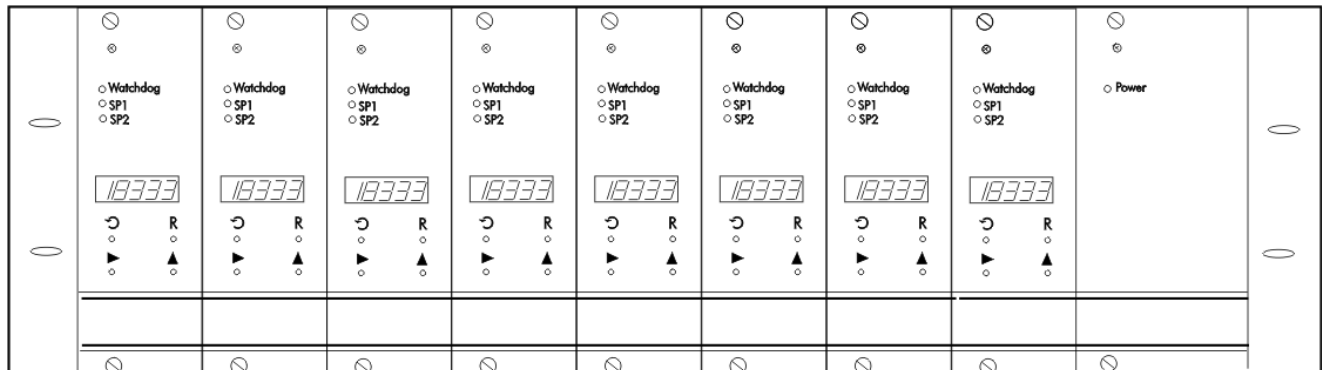
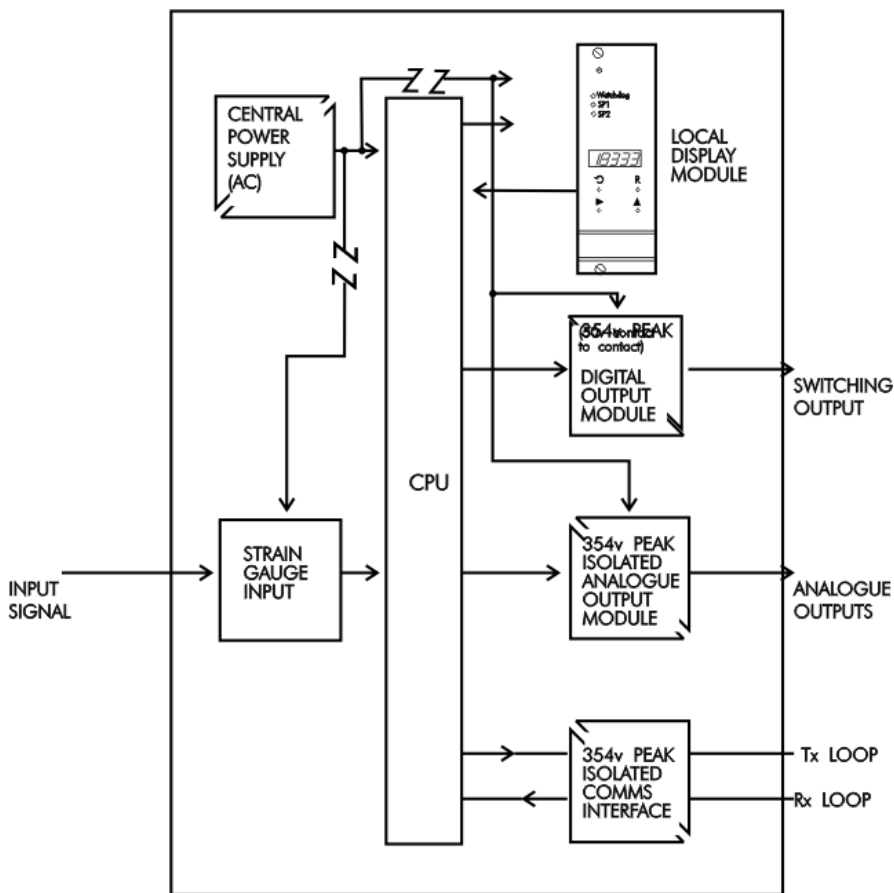


Figure 1.2 RCA15 (RL1) Remote Display/Programming



Figure 1.3 A Single Channel RCA15 Unit



Chapter 2 Installing and Connecting the RCA15

Environmental Approvals

Emissions BS EN 55011:1998

Immunity BS EN 61000-4-2:1995 IEC 6100-4-2:1995
BS EN 61000-4-3:2002
BS EN 61000-4-4:2004
BS EN 61000-4-11:2004

Output shall not exceed the sum of uncertainties when subjected to an electric field of 10V/m over the frequency range 80 to 600MHz

Safety/Low voltage Directive 73/23/EEC as amended by 93/68/EEC
BS EN 61010-1:2001 IEC 61010-1:2001

Inputs: Use individually screened twisted multipair cable. (e.g. FE 585 - 646)
The pairs should be :
pins 1 & 6
pins 2 & 5
pins 3 & 4
Terminate all screens at SCR. The screens should not be connected at the transducer end of the cables.

Comm's Port: Use individually screened twisted multipair cable. (e.g. FE 118-2117)
the pairs should be:
-Tx & +Tx
-Rx & +Rx
Terminate screens at SCR.
The screens should not be connected at the host port.

Analogue Output: Use screened twisted pair cable. (e.g. RS 626-4761)
Terminate screen at SCR.
The screen should not be connected at the host port.

SCR should be connected to a good Earth. The Earth connection should have a cross-sectional area sufficient enough to ensure a low impedance, in order to attenuate RF interference.

Cable Information (For Reference only)

Country	Supplier	Part No	Description
UK	Farnell	118-2117	Individually shielded twisted multipair cable (7/0.25mm)- 2 pair Tinned copper drain. Individually shielded in polyester tape. Diameter: 4.1mm Capacitance/m: core to core 115 pF & core to shield 203 pF
UK	Farnell	585-646	Individually shielded twisted multipair cable (7/0.25mm)- 3 pair Tinned copper drain. Individually shielded in polyester tape. Diameter: 8.1mm Capacitance/m: core to core 98 pF & core to shield 180 pF
UK	RS	626-4761	Braided shielded twisted multipair cable (7/0.2mm)- 1 pair Miniature- twin -round Diameter: 5.2 mm Capacitance/m: core to core 230 pF & core to shield 215 pF

Environmental Requirements

RCA15 units can operate in any industrial environment provided the following limits are not exceeded at the point of installation:

Operating Temperature:	-10 °C to 50 °C
Humidity:	95 % non condensing
Storage Temperature	-20 °C to +70 °C

Units can operate from the following:-

220/240V AC, 50/60Hz	110/240 Selected by a switch on the rear or the power supply module
110V AC, 50/60Hz	

Terminal Connections

Connection between the RCA15 modules and input/output signals, are made via screw connections to the rear of the rack.

Figure 2.1 RCA15 Back Plane Connection Terminals

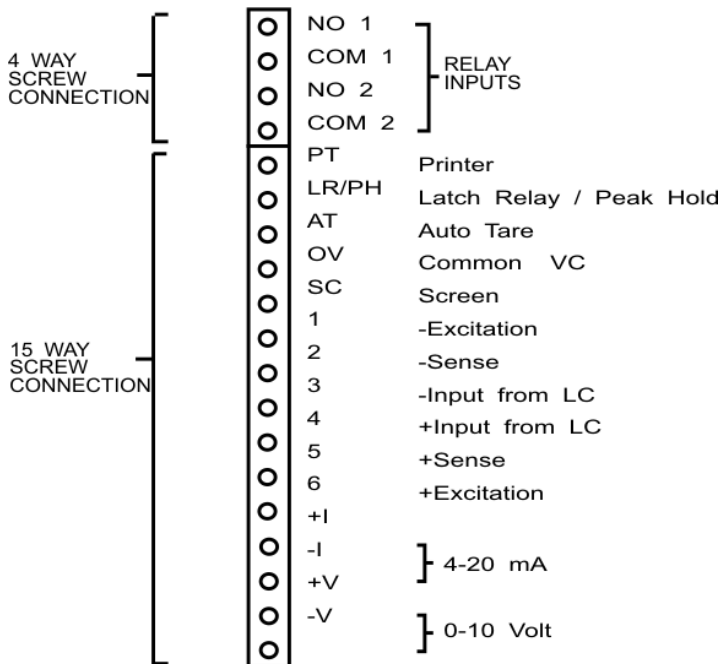


Figure 2.2 The 4 Wire Strain Gauge

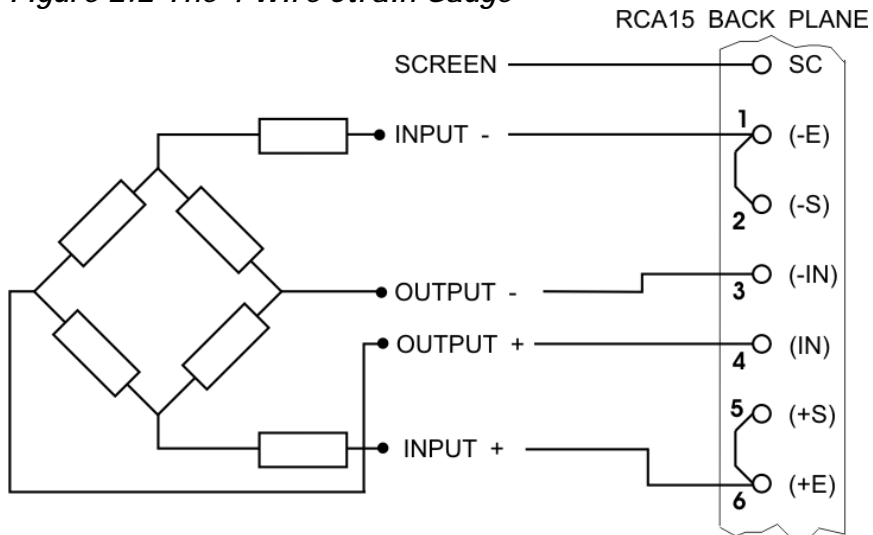


Figure 2.3 The 6 Wire Strain Gauge

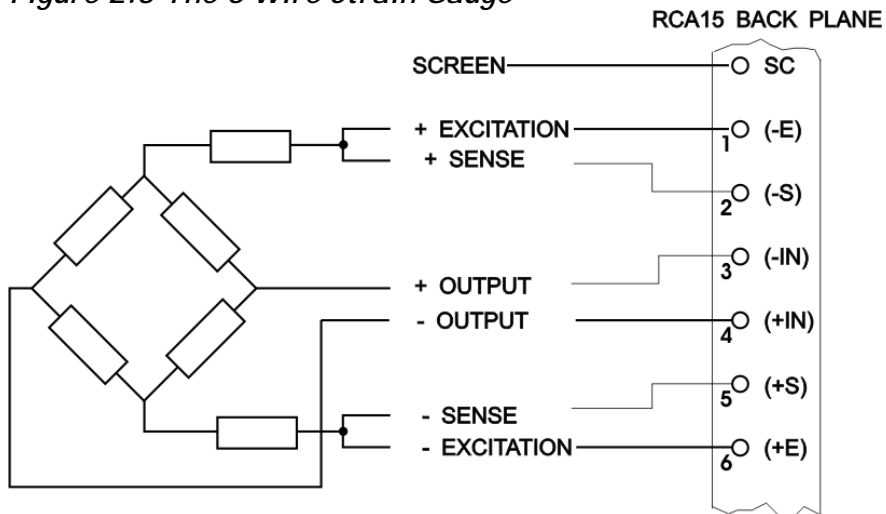


Figure 2.4 The 32 Way A & C (DIN41612) Connections

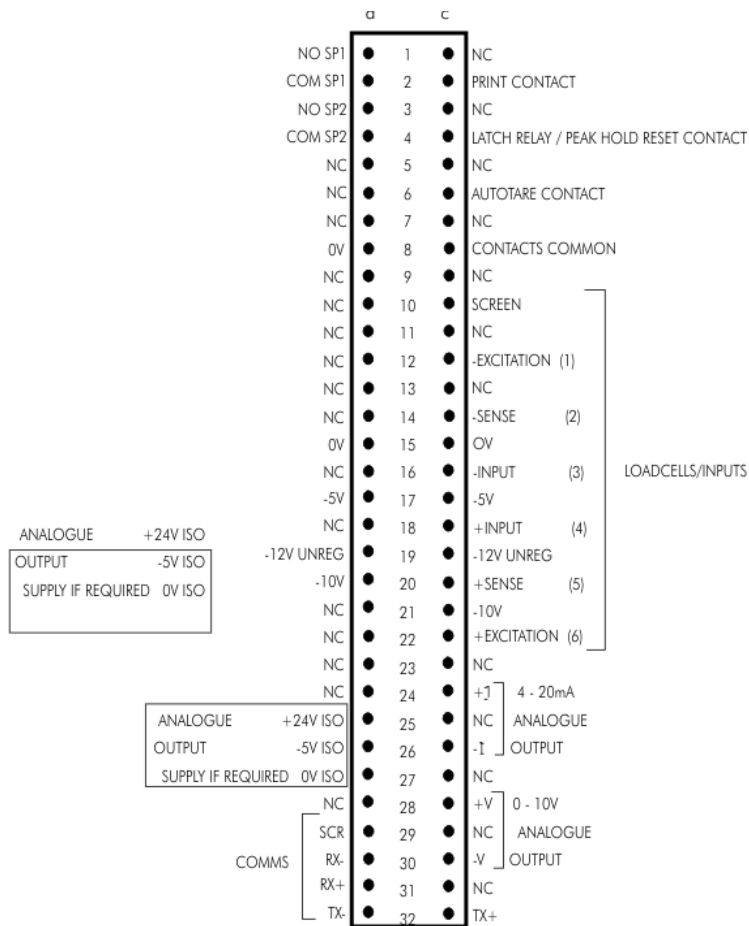


Table 2.1

	Supply	Connection to DIN 41612	Min V	Max V	Max AC V	Current	Comments
Processor Supplies	0V	15a, 15c	-	-	-	-	Common for Processor Supplies
	-5V	17a, 17c	-4.80	-5.2	1mA	110mA	Power Supply
	-14V Unreg	19a, 19c	-11	-18V	150mV	2mA	Used to detect Power Fail
	-9V8	20a, 20c	-9.1	-10.2	1mV	200mA	Provides excitation for Strain Gauges & Relays

Table 2.2

	Supply	Connection to DIN 41612	Min V	Max V	Max AC	Current	Comments
Analogue Output Isolated Supply	+24V ISO	25a	+20	+32	240mV	32mV	Only required if AN-OP to be used
	-5V ISO	26a	-4.75	-5.25	1mV	5mV	
	0V ISO	27a	-	-	-	-	

Chapter 3 The RCA15 Controls and Configurable Parameters

RL1 Programmer Unit - is a small hand held unit together with a connection lead, which plugs into a 'BT' type socket on the front panel of the RL1.

RL2 All user controls, displays and indicators are mounted on the front panel which provides a 4.5 digit, LCD display and four programming keys accessed through 2.2mm holes in the front panel.

A flashing ---- symbol in the top left hand corner of the display indicates programming mode.

Figure 3.1 Programmer Unit Panel Layout (RL1)

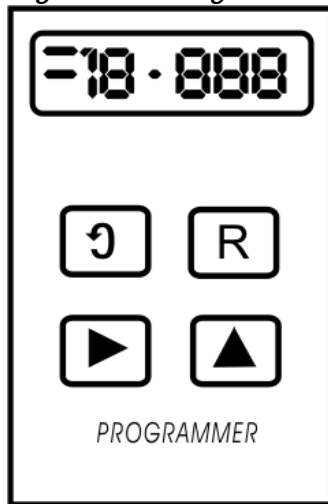
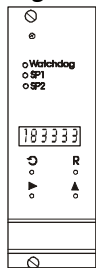


Figure 3.2 Programmer Unit Panel layout (RL2)



Control Panel Guide

- d Used to scroll through and change the set up data by displaying mnemonics for each configurable parameter, followed by the appropriate data. When in programming mode it should be noted that the first digit in the display may not be visible, but the program indicator --- will be flashing to indicate that the instrument is in programming mode, even though no digits can be seen to be flashing.
- b Selects the display digit required. Selection value is indicated by a flashing digit and flashing program indicator.
- c Increments each selected display digit 0-9. Pressing the c key under programming conditions will display the leading digit as either 1, -1, or a blank display for zero.
- a Resets the display to the input variable and enters new data in the LCA15 memory. Returns the display to the current value after Hold. If during the programming sequence, selection is not completed, the display will revert to the input variable after 2 minutes.

The display and controls on the front panel mounted version (RL2) operate in a similar way to the remote display/programmer described above, with program buttons being accessed through 2.2mm holes in the panel.

The Configurable Parameters

A series of parameters or programmable functions are provided in the RCA15 to allow the user good flexibility for monitor and control applications.

These parameters are included as constants in the RCA15 database and are accessed and checked via the programmer keypad or the communications port.

Data which is entered by the user is retained by EEPROM for up to 10 years without back up power.

New data, when entered, overwrites previous entries when the Ⓢ key is pressed unless the EEPROM has been disabled via the communications port.

Password Protection

A 4 digit password number must be entered. The number is accessed when 'PASS' is displayed. At this point, it is necessary to enter either the factory set number (1111) in digit positions 2-5, or the password number specifically ordered by the customer.

Configurable Parameters

Table 3.2

Code	Value	Function
PASS	±19999	Security Password. Correct value required to proceed further.
SP1	±19999	Set Point 1 'desired' trip value of output 1
IF1	±19999	In-Flight compensation for SP1 Relay 1 operates at = SP1 - IF1
SP2	±19999	Set Point 2 'desired' trip value of output 2
IF2	±19999	In-Flight compensation for SP2 Relay 2 operates at = SP2 - IF2
HYS	0-19999	Hysteresis amount applied to SP1 and SP2
OA	0-31	Output Action. Relays energize or de-energize above SP level. Analogue output normal or inverted, and latching
CALL	±19999	Calibration Low. Display value for low calibration point(Must be less than CALH)
CALH	±19999	Calibration High. Display value for high calibration point Note: When CALH = 0, the RCA15 display scaling is -19999 to +19999
At	±19999	Auto Tare value
dA	0-7	Display Averaging 1 to 64 standard display updates
	8-15	Display Averaging 1 to 64 display updates for peak hold
OPL	±19999	Output Low (minimum) Display point for minimum analogue output
OPH	±19999	Output High (maximum) Display point for maximum analogue output
dP	Decimal Point	Code dP Position 0 19999 To set the required position of the decimal point on the display. 1 1.9999 2 19.999 3 199.99 4 1999.9 5 19999.
Cp	0-129	Comms Protocol 0 to 127 = Printer, 128 = MANTRABUS, 129 = 'ASCII'
SdSt	0-254	Serial Device Station Number. This is the address code for each RCA15 when the communications port is used.
or		
LAb		Selects the desired label for the printer.
Ln		Log Number
rS	0-255	Sets Display Resolution 0 & 1 = Resolution of 1 least significant digit 2-255 = Resolution setting of last digits

InP Input Automatically returns the RCA15 to the input after scrolling
 Variable sequence is completed and updates permanent memory.

Note: Invalid parameter values - Should an invalid figure be entered against any parameter, it will be rejected and the display will return to show the parameter mnemonic.

Chapter 4 Strain Gauge Input to the RCA15

The Strain Gauge Input

The RCA15 offers a direct connection to most low level (foil) strain gauge sensors.

A 10 volt excitation is provided and it is monitored to compensate for any variation due to supply drift, load regulation or voltage drop in the cable between the sensor and the RCA15.

The maximum supply current is 160mA which allows for the connection of 4 x 350 Ohm Strain Gauges.

Strain Gauge sensitivity is preset via DIL switches to 0.5, 0.8, 1.0, 1.25, 1.5, 2.0, 2.5, 3.5, 5, 10, 20, 50, 100 and 200 mV/V. Select the next value higher than the Strain Gauge output maximum.

SW1 mV/V	1	2	3	4	5	6	7	8
0.5	-	x	x	-	-	x	x	x
0.8	-	x	-	-	-	-	x	x
1.0	-		x	x	-	-	-	-
1.25	-	-	x	-	-	x	x	-
1.5	-	-	x	-	-	-	-	-
2.0	-	-	-	x	x	-	-	-
2.5	-	-	-	x	-	x	-	-
3.5	-	-	-	-	x	x	-	-
5.0	-	-	-	-	x	-	-	-
10.0	-	-	-	-	-	x	-	-
20.0	-	-	-	-	-	-	x	x
50.0	-	-	-	-	-	-	-	x
100.0	-	-	-	-	-	-	-	-
200.0	x	-	-	-	-	-	-	-

x = ON - = OFF

mV/V = \pm mV/V nominal full range gain within \pm 3%

Hardware Configuration:

The RCA15 is supplied set to \pm 2.5mV/V maximum. To check if the Strain Gauge and application is within this range, apply the following formula:

$$\frac{\text{Maximum load (weight)} \times \text{Strain Gauge output voltage}}{\text{Strain Gauge rated range}}$$

For example:

$$\frac{1.5 \text{ tonne} \times 2.5\text{mV/V}}{2 \text{ tonne}} = 1.875\text{mV/V}$$

If the resultant figure is \pm 2.5mV or less, then the Auto Calibration can be carried out.

If it is greater. Select a higher setting with the DIL switch as necessary.

Before any calibration can be set, it will be necessary to decide upon the calibration values and place the decimal point in the appropriate position. To do this, scroll through the parameters, entering the password as appropriate (as described in Chapter 3), until the decimal point parameter is reached (dP-r). Once the decimal point is set, the Auto Calibration parameters can be set in real engineering terms.

Auto Calibration

Connect the Strain Gauge, switch on the RCA15. Connect the Programmer for (RL1) version. Allow a warm up period of 10 minutes before carrying out the procedure as follows;

- a) Press the **d** key until PASS appears.
- b) Enter the password using **b** and **c** keys, then press **d** key.
- c) Keep pressing the **d** key until CALL (Cal Low) appears.
- d) Press the **b** key and check that the program light flashes.*

**IMPORTANT NOTE: Always ensure that the programmer indicator flashes, even though the displayed value may not need to change.*

- e) Check that the displayed value agrees with the low calibration weight applied to the Strain Gauge (this may be zero).

If this is not correct, alter the display value by pressing the **b** & **c** keys.

Ensure that the Strain Gauge is free from disturbance and press the **d** key to capture and calibrate the CALL value.

- f) CALH (Cal High) now appears on the display.
- g) Press the **b** key and check that the program light flashes.
- h) Apply the known higher value weight.

Check that the displayed value agrees with the high calibration weight applied to the Strain Gauge.

If this is not correct, alter the display value by pressing the **b** & **c** keys.

Ensure that the Strain Gauge is free from disturbance and press the **a** key. The display will now indicate the Strain Gauge auto calibrated high value.

- Note 1: The Calibration value is not entered into the memory until either the **d** key or the **a** key is pressed.
- Note 2: CALH must always be greater than CALL, in both weight and entered values.
- Note 3: Pressing the **a** key at any time will return the display to normal operation.
- Note 4: For best accuracy and resolution, the calibration weight should be approximately 75% of the Strain Gauge capacity.
- Note 5: For range check before Autocal, set CAL H to 0 and display will be that of the A/D counts. It is important that the A/D span between the CALL weight and CALH weight, is greater than the span of the values entered for CALL and CALH, otherwise the display resolution will not be 1digit.
- Note 6: CALH can be set before CALL if required.
- Note 7: CALH and CALL can be programmed individually with any time period between provided that the **a** reset key is pressed to store the value.

Auto Tare

The auto tare facility allows for any unwanted weight or tare value to be compensated for in the weighing process.

Compensation is achieved by operating a closing contact connected between the 'AT' terminal and zero volts, on the field terminals.

It is possible to view the Auto Tare value by scrolling to the 'At' mnemonic which will display the offset present in the Auto Tare mode.

If required Auto Tare can be adjusted to any desired value to give a zero or fixed offset. The unit may also be 'Tared' from the 'Reset' terminals - see dP-r mnemonics in Chapter 3

Display Averaging (dA)

In certain applications, due to the rapid changes in the display, the least significant digits may not be readable. In these cases, the RCA15 readings may be averaged over a number of updates and can be set as follows:

Table 4.1

	Display update time
0 = 1 reading (standard)	approx 0.4s
1 = 2 readings	approx 0.8s
2 = 4 readings	approx 1.6s
3 = 8 readings	approx 3.2s
4 = 16 readings	approx 6.4s
5 = 32 readings	approx 12.8s
6 = 64 readings	approx 25.6s
7 = Fast update mode	approx .1s

Display Averaging with Peak Hold

A Peak Hold function, which will display and hold the highest recorded value of the measured input, can be set through the Display Averaging setting by adding 8 to any of the above settings. Reset Peak Hold by operating a closing contact connected between 'LR/PH' terminal and '0' volts, on the field terminals.

Where an Auto Tare value and Peak Hold are both operative, it is important to be aware that an Auto Tare function, although activated in the normal way, will zero the input but not the display, which will retain the peak value.

Peak hold will hold the analogue output relay and comms value.

Input Filtering

Response for 15mV rms at 50Hz signal applied on a 25mV Full Range Input will give 1 part in 1,500 display digit noise.

Chapter 5 Analogue Outputs

Two analogue outputs are available offering a DC current range and a DC voltage range. They are fully scalable, optically isolated and generated from the displayed input value. The 4 to 20 mA output is pre calibrated to an accuracy of within 0.15% of the range. The 0-10V output is accurate to within 2% of the 4 to 20mA output.

OUTPUT	RANGE
DC voltage	0V to 10V
DC current	4 to 20mA

Notes:

1. Maximum current load on voltage modules is 2mA
2. Maximum drive voltage available in current modules is 20V.
3. Accuracy 4-20mA $\pm 0.15\%$ of range, typical. Resolution as for display up to 13 bits/4.5 digits. Settling time 0.25 secs to 1% of step change.
4. Isolation $\pm 130V$ RMS or DC max to analogue input or any other port. Common to other analogue outputs in the same rack.

Output Scaling

Output scaling factors are set by the user and determine the display range over which the analogue module operates. (OPL) Output Low - This sets the displayed value at the modules minimum output. (OPH) Output High - This sets the displayed value at maximum output. If the display is outside the range defined by OPL and OPH, the analogue output will remain constant at its minimum or maximum output value.

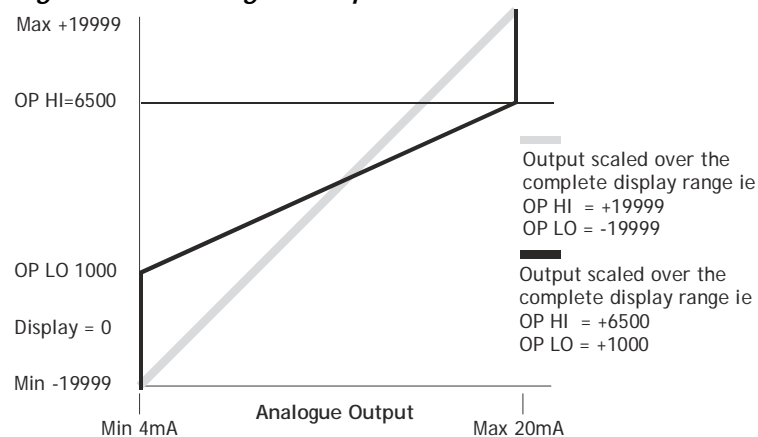
Inversion of the analogue output can be set by the output action mnemonic OA (See Relay Output Module Chapter 6).

Example: Assume a 4-20mA output module is required to provide an output of 4mA for 1000Kg and 20mA for 6500Kg.

Set OPL to 1000 and OPH to 6500

It will be necessary to determine OPL and OPH by graphical or mathematical means if the known display values do not coincide with the minimum and/or maximum analogue output.

Figure 5.1 Analogue Output



Method of Calculating OPL and OPH from any known output values

$$\text{OPL} = \frac{\text{Low Display} \cdot (\text{High output} - \text{Low output}) - (\text{Display span}) (\text{Low output} - \text{Min output})}{(\text{High output} - \text{Low output})}$$

$$\text{OPH} = \frac{\text{High Display} + (\text{Display Span}) (\text{Max output} - \text{High output})}{(\text{High output} - \text{Low output})}$$

Low output = Known low output

High output = Known high output

Min output = Lowest measurable value of output module

Max output = Highest measurable value of output module

Display span = Highest required display value minus lowest required display value.

Example:

Using a 4.20mA output module where it is required to produce 6mA at a display value of 400 and 18mA at a display value of 1100.

$$\text{OPL} = 400 - \frac{(700)(6 - 4)}{(18 - 6)} = 400 - \frac{1400}{12}$$

$$\text{OPL} = 400 - 116.66$$

$$\text{OPL} = \underline{283.34}$$

$$\text{OPH} = 1100 + \frac{700(20 - 18)}{(18 - 6)} = 1100 + \frac{700 \times 2}{12}$$

$$\text{OPH} = 1100 + 116.66$$

$$\text{OPH} = \underline{1216.66}$$

Note 1: OPH must be greater than OPL

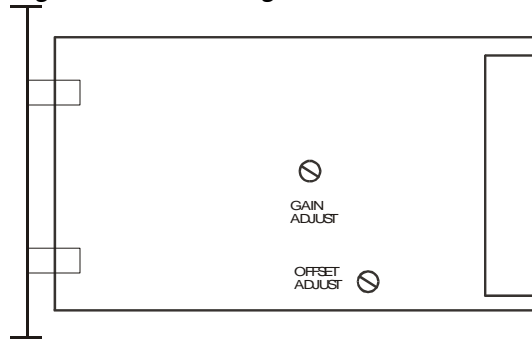
Note 2: If OPL or OPH are greater than ± 19999 then divide both OPL and OPH by 10, this will give less resolution.

Decimal point can be placed anywhere to suit reading.

Calibration

Re calibration can be made by adjusting the gain and offset potentiometers, or by adjusting the values of OPL and OPH. An offset can be achieved by increasing the values of both OPL and OPH, and the gain by increasing the range between OPL and OPH.

Figure 5.2 Showing the Potentiometers for Gain and Offset Adjustment



Chapter 6 Relay Output Module

General Description

The Relay output module provides output control signals which can be used for switching functions such as ON/OFF control and alarm indications. The relays are activated by the values programmed for the Set Points. The output configuration will be for open or closed relay contacts and latching.

Output	Function
2 Relays	SPCO on SP1 and SP2

The connections for which are shown on Chapter 2

Module Functions

The RCA15 can be programmed so that the relay output module reacts to all or any of the following functions:

- Set points
- In Flight compensation
- Hysteresis
- Relay inversion
- Latching

Set Points (SP)

Set points are used to produce output signals at any required value so that the operation of the monitored process can be maintained to preset levels. Any excursion beyond set points will activate the relay or relays, to provide alarm or initiate control as required.

Two set points (SP1) and (SP2) can be programmed to suit different applications. The actions of either or both set points can be inverted if required. For normal operation the set point output is active until the input reaches the set point level. In this condition when the input value is less than the set point, the SP indicator is on and the output relay is energized producing a closed circuit on a normally open contact. When the set point value is reached, the SP indicator is off and the relay is de-energized producing an open circuit output. For an inverted operation the reverse conditions apply.

Normal and inverted action is determined by the direction of the input value as it changes. For example: In alarm applications.

A High-High operation allows for a rising input value to operate on two set points to define an acceptable quantity, weight or band of operation.

A Low-Low operation operates on a falling value.

A High-Low operation will operate on a rising or falling value, setting a 'band' by one set point operating normally and the other being an inverted action.

In Flight Compensation

The setting of an In Flight value causes the set points to automatically adjust to control the flow of the material being weighed.

For example, if SP1 is used to control a flow, a certain amount will be 'In Flight' between the supply point and receiving point causing a positive error when the required weight is reached. The In Flight compensation value is adjusted by the user to 'reduce' SP1 to prematurely stop the flow, allowing the In Flight amount to make up the required total set by SP1. A similar situation exists for SP2.

Hysteresis (HYS)

Once a Hysteresis value has been set, it will be applied to both set points entered. It is effective for both normal and inverted action.

When Hysteresis is applied to set points with normal output action, the input is allowed to rise to the set point

value and the output is then turned off. The output is held off until the input value has dropped to the set point minus the Hysteresis value.

For inverted action the input drops to the set point and the output goes off and comes on again when the input rises to the set point plus the Hysteresis value.

Output Action (OA)

The Output Action facility allows the user to determine whether set points produce normal or inverted and latched or unlatched output operation. If an analogue output module is also fitted, the Output Action function determines whether the module's output is inverted or not. The Output Action (OA) is entered by a code to suit the requirements of the user. Thirty two Output Action options are available. The value of the OA to be entered is the algebraic sum of the following components:-

SP1 Inverted	= 1
SP2 Inverted	= 2
AN-OP Inverted	= 4
SP1 Latched	= 8
SP2 Latched	= 16

Example 1: If SP1 requires to be latched and inverted and the analogue output is normal, enter $8 + 1 = 9$

Example 2: To invert the analogue output and latch SP2, enter $4 + 16 = 20$

Latching Outputs

The latching facility allows the relay module output to be held until reset externally. Latching is applied to the off status of the relay SP1 or SP2.

Chapter 7 The Communications Port

Introduction

The RCA15 communications port provides for a 2 way data link. An intelligent host e.g. Personal Computer, Main Frame or PLC is able to acquire the RCA15's displayed value and read or modify the user configurable parameters, using any of the following:-

- a) RS232 - for a one to one communication (as in the case of a printer).
- b) RS485 - for the connection of up to 25, RCA15 modules on a single RS485 line.
- c) 20mA Current Loop - for up to 250, RCA15 modules on a single RS232 line, via the IF25 interface. With high noise immunity and isolation over distances up to 1Km.

All modules provide isolation.

4 communication formats, FAST MANTRABUS, ASCII and PRINTER, are selected from the mnemonic CP via the keypad, of the programmer.

Integrity is ensured by preprogrammed default parameters should a loss of communications with the host occur.

RL1 & RL2 are fitted with a systems Comms connection identified by a RED plate at the power supply end of the rack. This provides the connection for multi-drop applications to PC or PLC.

Channels 2 and upwards are fitted with 9 way 'D' type sockets, to provide Comms connections for 20mA current loop and RS485 to the Comms bus or in the case of RS232, connection to the individual channels RS232 ports.

Channel 1 is provided with links to allow connections for 20mA current loop and RS485.

Supplied with Comms modules RC1 and RC3 is a 9 way 'D' type link header (BLUE for RC1 and GREEN for RC3). These headers must be connected to the appropriate channel sockets to ensure effective comms bus connections. Ensure that channel 1 is linked as shown in the following module sections.

RC1 Communications Connections - Current 1 Loop

RC1 used in connection with an IF25 to provide a high noise immunity 20mA current loop. RC1 modules are supplied with a blue 9 way bus terminating header. One of these headers must be connected to each channel fitted with an RC1 module. Channel 1 is terminated by links LK1 & LK2 on back-plane.

Figure 7.1 RC1 Communications Connections

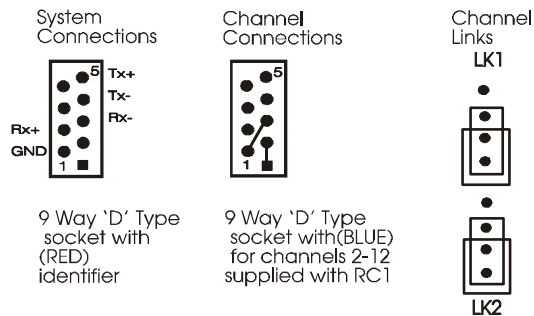


Figure 7.2 -RC1 Baud Rate Selection

Baud rate is selected by a link header (SW1)

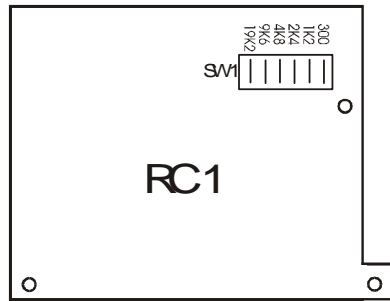
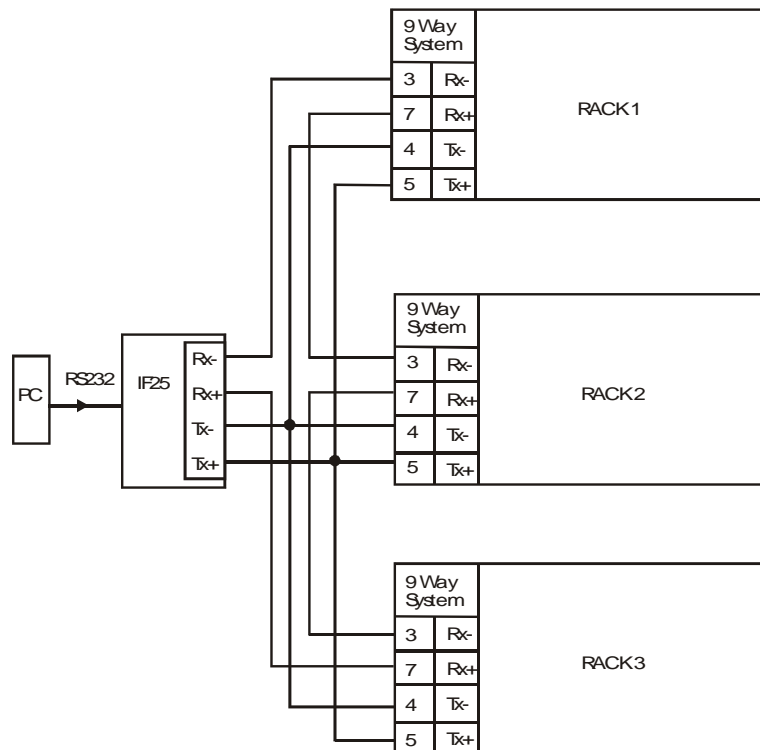


Figure 7.3 - Connecting Multiple RCA15s

IF25 To Multi Rack System



Notes:

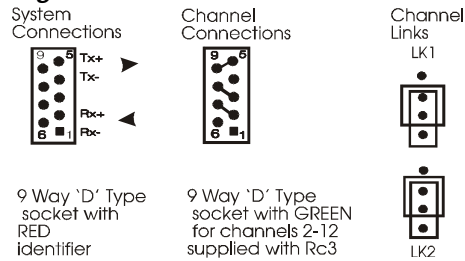
1. Maximum loop voltage is 50V dc.
2. Loop is isolated from host and RCA15s. Loop should be earthed via Rx - on IF25/254
3. IF25 used for up to 25 RCA15s.
4. At 19,200 Baud, max. cable length is 100m meters, using cable type BICC H8085.

RC3 (RS232/485) Communication Connections

Providing isolated multi-drop RS485 for up to 25 RCA15 Channels.

For each RC3 module a GREEN 9 way bus terminating header is supplied. One of these must be connected to each channel fitted with an RC3 module. Channel 1 is terminated by links LK1 & LK2 on back plane.

Figure 7.4 RC3 RS232/485 Communications Connections

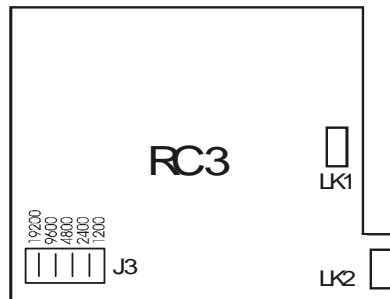


Note: The last device may be terminated by 120R resistor by fitting LK2 on RC3 module. LK1 on RC3 must not be fitted for multi-drop applications.

Figure 7.5 RC3 Baud Rate Selection

Baud Rate is selected by a link header (J3)

Do not change baud setting with power on



NOTE:

When using an RS232 to RS485 converter which has a non-biased receiver, the following actions are recommended:- To bias the device:

1. Terminate the receiver with 140R in place of the usual 120R
2. Fit a 1.5K from the receive negative to the receiver +5V supply, or a 3K3 to the +12V supply.
3. Fit a 1.5K from the receive positive to the receiver supply Ground.

Serial Communication Protocol

General

Incoming data is continually monitored by the RCA15 on its serial input line. Each byte of data is formatted as an eight bit word without parity, preceded by one start bit and followed by one stop bit. Transmission and reception of data up to 19.2K Baud is possible, the actual rate being selected by six position header links on the communications module. The Baud rate depends upon the communications, hardware specification, distance and cable type.

Fast MANTRABUS Format - selected when CP is 128

To signify commencement of a new 'block' of data, the HEX number FFH is used as a 'frame' character, followed by the station number of the unit under interrogation. This is entered via the RCA15 keypad under mnemonic SDSt and ranges from 0-254). The RCA15 acts upon incoming data only if its own station number immediately follows the FFH character.

New data must be received as a string of four nibbles (bits 7-4 set to zero) which are assembled into two bytes and written into the variables store within the RCA15. The most significant nibble must be received first and the last nibble must have the most significant bit (bit 7) set to indicate the end of data. This is followed by the checksum. The data transmitted from the RCA15 is always sent as complete bytes. The station number precedes the data and the checksum follows the data. The data format used is signed 15 Bit. The most significant Bit of the most significant Byte is set for negative numbers.

Operation

There are two modes of operation, namely data requests by the host controller and data changes. Data requests from the RCA15 consist of either a complete dump of the data variables stores in RAM or the display reading. Data changes consist of writing new data to RCA15 variables, thus changing parameters such as Set Points, in flights etc.

An acknowledgement message is returned to the RCA15 to indicate that the new data has been acted upon.

Updating

The required mode or variable to be updated is determined by the station number followed by the command byte. An EXOR checksum consisting of the station number command byte and any following data must be appended to the received data. It is most important that the byte proceeding the checksum must have its most significant bit set to signify the end of data.

The RCA15 works out its own checksum and, if it disagrees with the received one, a not acknowledge (NAK) message is returned.

Communications Commands

The following is a list of commands available for reading to or writing from the RCA15.

Command No.

DEC	HEX	Description
1	1	REQUEST ALL DATA INCLUDES WEIGHT INPUT
2	2	REQUEST DISPLAY DATA
3	3	UPDATE SET POINT 1 (SP1)
4	4	UPDATE IN-FLIGHT 1 (IF1)
5	5	UPDATE SET POINT 2 (SP2)
6	6	UPDATE IN-FLIGHT 2 (IF2)
7	7	UPDATE HYSTERESIS (HYS)
8	8	UPDATE OUTPUT ACTION (OA)
9	9	RESERVED
10	A	RESERVED
11	B	RESERVED
12	C	RESERVED
13	D	UPDATE AUTO TARE (At)
14	E	UPDATE DISPLAY AVERAGES AND HOLD FUNCTION (dA)
15	F	UPDATE OUTPUT LOW (OPL)
16	10	UPDATE OUTPUT HIGH (OPH)
17	11	UPDATE DECIMAL POINT AND RESET FUNCTION (DP)
18	12	CAN NOT BE WRITTEN TO, AND RCA WILL RETURN A NAK (SDSt/CP)
19	13	EEPROMENABLE/DISABLE
20	14	OUTPUT RELAY RESET
21	15	AUTO TARE
22	16	PEAK HOLD RESET

Command 1 Request for all data:

DATA TRANSMITTED TO RCA15 FOR COMMAND 1

0FFH, Station Number, 081H, Chksum

Where Chksum = Station number EXOR with 081H. Example: To obtain a complete dump of the variables in the RCA15 whose Station number is 47 send the following Data:-

0FFH, 02FH, 081H, 0AEH

 |
 Note MS Bit Set

Response To Command 1 From RCA15

Byte

1 Station Number

2,3	DISPLAY
4,5	SET POINT 1
6,7	IN FLIGHT 1
8,9	SET POINT 2
10,11	IN FLIGHT 2
12,13	HYSTERESIS
14,15	OUTPUT ACTION
16,17	A/D COUNTS FOR LOW CALIBRATION POINT
18,19	A/D COUNTS FOR HIGH CALIBRATION POINT
20,21	DISPLAY LOW CALIBRATION VALUE
22,23	DISPLAY HIGH CALIBRATION VALUE
24,25	AUTO TARE
26,27	DISPLAY AVERAGING
28,29	OUTPUT LOW
30,31	OUTPUT HIGH
32,33	DECIMAL POINT POSITION
34,35	STATION NUMBER
36	EEPROM ENABLE/DISABLE FLAG
37	RELAY STATUS
38	EXOR CHECKSUM OF THE ABOVE DATA

NOTE: Most significant byte precedes least significant byte for data sent by RCA15

Command 2 Request Display Data

DATA transmitted to RCA15 for Command 2.
0FFH, Station number, 082H, Chksum

Where Chksum = Station number EXOR with 082H Example: To obtain the display reading of an RCA15 whose station number is 47 send the following Data:

0FFH, 02FH, 082H, 0ADH

|
Note MS Bit Set

Response To Command 2 From RCA15

Byte

1. Station No.
2. Display reading M.S. Byte.
3. Display reading L.S. Byte.
4. EXOR checksum of above data and Station No.

If, when using commands 1 or 2, an error is detected by the RCA15 then the Not Acknowledgement string is transmitted by the RCA15.

Commands 3 To 18: Write data to RCA15 Parameter

Commands 3 to 18 all have the same format. Format for data transmitted to RCA15 for Commands 3 to 18:-
0FFH, Station No, Command No, MSN, NMSN, NLSN, LSN, CHKSUM

- Where MSN = Most significant nibble of data
 NMSN = Next most significant nibble of data
 NLSN = Next least significant nibble of data
 LSN = Least significant nibble of data with MSBIT set
 CHKSUM = The following EXOR'd with each other, Station number, command number, MSN, NMSN, NLSN, LSN with MSBIT set

Example: To change SP1 to 200.0 on an RCA15 whose station number is 47. The following data is sent. Please note the following points apply:-

1. The decimal point is ignored i.e. 200.0 equals 2000 digits
2. The data is sent in Hex nibbles so 2000 = 00H, 07H, 0DH, 00H

0FFH,02FH, 03H, 00H, 07H, 0DH, 80H, 0A6H

|
Note MS BIT SET

Response To Command 3 to 22

If the data has been accepted by the RCA15 then the following acknowledgement string is transmitted by the RCA15.

Station number, 015H (NAK)

If there are any errors with the data received by the RCA15 then the following Not Acknowledgement (NAK) string is transmitted by the RCA15:-

Station number, 06H (ACK)

Command 19: EEPROM ENABLE / DISABLE

The EEPROM disable facility can be used for any of the following:

- (i) To limit the number of write cycles to EEPROM reducing degradations.
- (ii) Change data in the RCA15 RAM only, allowing EEPROM to hold power up values.
- (iii) Leave base constants in the EEPROM for later update to RAM, which allows manipulation of the RAM before writing to the EEPROM.

Writing new data from the RAM to the EEPROM.

EEPROM disable is achieved by writing 0100H to the RCA15 via command 19. In this state all writing to, or reading from the EEPROM is inhibited.

The EEPROM can be re-enabled in 2 ways:

By writing 0200H via command 19. This writes the current contents of the variables store in the RCA15 into the EEPROM

By writing 0400H via command 19. This updates the variables store from the current contents of the EEPROM.

Examples

To disable the EEPROM on an RCA15 whose Station number is set to 47

0FFH 02FH 013H 00H 01H 00H 080H 0BDH

To re-enable the EEPROM and update the RAM with the old EEPROM constants:

0FFH 02FH 013H 00H 04H 00H 080H 0B8H

To re-enable the EEPROM and update it with the new RAM data:

0FFH 02FH 013H 00H 02H 00H 080H 0BEH

For response see 'Response to Command 3 to 22'.

COMMAND 20: Output Relay Reset

DATA transmitted to RCA15 for Command 20

0FFH, Station number, 094H, CHKSUM

Where CHKSUM = Station Number EXOR with 094H Example: To output a relay reset to an RCA15 whose Station Number is set to 47

0FFH, 02FH, 094H, 0BBH

|
Note MS BIT SET

For response by RCA15 see 'Response to Commands 3 to 22'

Command 21: Auto Tare

DATA transmitted to RCA15 for Command 21

OFFH, Station number, 095H, CHKSUM

Where CHKSUM = Station Number EXOR with 095H Example: To output an Auto Tare command to an RCA15 whose Station Number is set to 47

OFFH, 02FH, 095H, 0BAH

|
Note MS BIT SET

For response by RCA15 see 'Response to Commands 3 to 22'

Command 22: Peak Hold Reset

DATA transmitted to RCA15 for Command 22

OFFH, Station number, 096H, CHKSUM

Where CHKSUM = Station Number EXOR with 096H Example: To output a Peak Hold reset to an RCA15 whose Station Number is set to 47

OFFH, 02FH, 096H, 0B9H

|
Note MS BIT SET

For response by RCA15 see 'Response to Commands 3 to 22'

Example of a Basic Code to Communicate with Fast MANTRABUS

open the serial port with no handshaking

```
OPEN"COM2:4800,N,8,1,RS,DS,BIN" FOR RANDOM AS#1
```

request display from device 1

Frame FF	Station No	Command 2	Checksum of
	1	And add 80 hex to this byte as it is the last before as the checksum	all bytes except frame

```
talk$=CHR$(&HFF)+CHR$(&H1)+CHR$(&H82)+CHR$(&H1 XOR&H82)
```

print the string to the port

```
PRINT#1,talk$;
```

(must add semicolon after string to stop transmitting a carriage return)

wait for a while (this depends on how many bytes you are expecting and the baud rate!)

input all the bytes in the serial buffer

```
input.from.rca$=INPUT$(LOC(1),#1)
```

ASCII Format - selected when CP is 129

The serial data to and from the RCA15 is formatted as eight bit words with no parity preceded by one start bit and followed by one stop bit. The baud rate (up to 9.6k Baud) is selected on the COMMS module. All communications are carried out using the standard ASCII character set. Incoming line feeds and spaces are ignored; upper and lower case letters are permitted. The incoming data is continually monitored for Carriage Return characters (Chr\$13D). If one is received the next three characters (000 - 999) are compared with the RCA15 station number (SDST) previously entered via the keypad. N.B. leading zeros must be included. If no match is found the data that follows is ignored.

The next characters received (up to 4 max) are decoded as the 'label', ie. which variable in the RCA15 is to be acted upon. If the label is received incorrectly and cannot be decoded the RCA15 will return a '?' followed by a C.R. character. If the received label is followed by a C.R. the RCA15 will return the current value of the variable in question. *Because there is no hardware handshaking, all transmission from the RCA15 is performed one character at a time upon receiving a Null character (Chr\$0) prompt from the Host system. Thus for every character transmitted by the RCA a prompt character is required from the host.* The output from the RCA15 is an ASCII string of sixteen characters the last one being C.R. The first four characters are the Station No. (with leading zeros if necessary) followed by a space. The label then follows with spaces added if required to make a total of four characters. The next seven characters is the numerical value of the required variable with polarity, spaces, d.p. and leading zeros added as required.

If the received label is followed by an '=' character the RCA15 accepts the following numerical data (which must be terminated by a C.R.) and updates the variable in question and returns a C.R. character to the host when prompted. Data input is reasonably flexible. If all five digits are entered, no decimal point need be included. If less than five digits are entered with no decimal point then the last digit is assumed to be the units.

Under normal circumstances the EEPROM in the RCA15 continually refreshes the working RAM. However, it can be disabled via the serial input, by sending the instruction 'DROM = 256' after the Station No. In this condition all read/write operations to or from the EEPROM are inhibited. There are two instructions which will re-enable the EEPROM:

1. 'ERRD' - this performs a read from the EEPROM and updates the working RAM with the contents of the EEPROM.
 2. 'ERWR' - this instruction writes the new RAM values into the EEPROM.
- In both cases the EEPROM continues to refresh the RAM.

Instruction Set for ASCII Serial Communications

Request for data:

DATA sent to RCA15			Data returned from RCA15		
CR xxx	DISP	CR	xxx 'SPACE'	DISP	YYYYYY CR
Station No.	label		Station No.	label	numerical value
CR xxx	DOSP	CR	xxx 'SPACE'	DOSP	'SPACE' ? CR
Station No.	incorrect label		Station No.	incorrect label	

DATA sent to RCA15		Data returned from RCA15	
CR xxx	SP1 = 100.0	CR	

Station No., label numerical value

CR xxx	SP3 = 100.0	?CR
Station No.,	incorrect label	
	numerical value	

Table 7.1

Labels	Description
DISP	REQUEST DISPLAY READING
SP1	SET POINT 1 (SP1)
IF1	IN-FLIGHT 1 (IF1)
SP2	SET POINT 2 (SP2)
IF2	IN-FLIGHT 2 (IF2)
HYS	HYSTERESIS(HYS)
OA	OUTPUT ACTION (OA)
At	AUTO TARE(At)
DA	DISPLAY AVERAGES (dA)
OPL	OUTPUT LOW (OPL)
OPH	OUTPUT HIGH (OPH)
DP	DECIMAL POINT (dP r)
SDST	CAN NOT BE WRITTEN TO (SDST/CP)
DROM	DISABLE EEPROM (DROM = 256)
ERRD	ENABLE EEPROM AND READ FROM IT
ERWR	ENABLE EEPROM AND WRITE TO IT
RLYS	OUTPUT RELAY STATUS (0 = BOTH OFF, 1 = RELAY 1 ON, 2 = RELAY 2 ON, 3 = BOTH RELAYS ON)
RES	OUTPUT RELAY RESET
TARE	AUTO TARE
PKR	PEAK HOLD RESET

RCA15 Printer Format

(CP must be set between 0 - 127)

Printer selection enables the RCA15 to print its current display value to a printer via its communications port. This display value can either be assigned a date and time stamp and/or a log number depending on the user set options entered under mnemonic 'CP'. The log number can be reset or preset using the mnemonic 'Ln'. This value is not saved on power fail. A label can be suffixed to the printed display value using the mnemonic 'LAB'. A large range of labels are available to the user.

The time and date are set in the TDP printer itself using its own menu. The printer allows the entry of an additional custom text message.

Three connections are required between the RCA15 communications port and the printer with a maximum cable length of 100 meters.

All standard RCA15 options are available with the exception of the communications modules, which cannot be connected when the printer option is used.

Additional Mnemonics for the Printer Operation:

When the printer option is fitted further mnemonics are included in the normal range. After the dP r mnemonic are the following:-

- CP At this mnemonic the printer type and print format number is selected. This number being appropriate to the type of printer used. Details are advised with each type of printer selected.
Present types available are:- For the ITT IPP-144-40E printer the following numbers apply
- 0 Prints a sequential log number with the current display and unit of measure
e.g. 00014 0011.3 tonne
- 1 Prints date and time with a sequential log number, current display and unit of measure
e.g. 00015 0001.7 tonne
13.07.99 12:05:06

2 Prints a sequential log number, current display, unit of measure with customer text message No 1

e.g. MANTRACOURT ELECTRONICS RCA15 PRINTER
00012 00023. tonne

3 Prints date and time with a sequential log number, current display, unit of measure and a customer text message No.1

e.g. MANTRACOURT ELECTRONICS RCA15 PRINTER
00013 0023. tonne
13.07.99 12:03:04

4-7 Digitec 6700 series

8,9 Amplicon AP24 and AP40

10 Eltron LP2142 - (The label file must be called 'MEL' and the label must contain a LOG NUMBER, THE DISPLAY VARIABLE & a LABEL (not zero).
LOG NUMBER, THE DISPLAY VARIABLE & a LABEL (not zero)

12 ASCII string on print command

127 Continuous ASCII stream of the display data, transmitted on every display update

Note:1 9 gives an inverted print out

Note: 2 it is anticipated that further types of printer will be added, and additional numbers will be allocated as appropriate

LAB Label Number

A number can be selected for the appropriate unit of measure. See table below:

Note: 0 = NO LABEL

0 BLANK

1 Deg R 18 m 35 ton 52 RPM1000

2 Deg C 19 in 36 %Dev 53 Hz

3 Deg F 20 ft 37 W 54 kHz

4 Kelvin 21 degrees 38 kW 55 V DC

5 lb/in 2 22 L/s 39 MW 56 mV DC

6 bar 23 L/min 40 pH 57 A DC

7 mbar 24 L/h 41 ppm 58 mA DC

8 kPa 25 gals/s 42 uS 59 V AC

9 atm 26 gal/min 43 Ohms 60 mV AC

10 mmHg 27 gal/h 44 m/s 61 A AC

11 inHg 28 %RH 45 ft/min 62 N

12 inH2O 29 gram 46 RPM 63 spare

13 cmHg 30 kg 47 RPMx10 64 spare

14 mm 31 lb 48 RPMx100 65 spare

15 Wh 32 kWh 49 cos @ 66 spare

16 Db 33 mile/h 50 km/h 67 knots

17 tonne 34 % 68 s

51 ms

Ln Log Number

A range of numbers 0 to 19,999 is available. Any sequential number logging activity can be preset as desired, between these numbers. The number will reset to zero after 19,999. The log number is not saved on power fail and resets to zero on power up.

Chapter 8 Trouble Shooting Guide

This chapter is designed to assist in the identification of problems relating to the installation and setting up of the RCA15.

1. General Connection and setup parameters.

No display on power up.

- a) Check supply is present at the RCA15 terminals.

Display shows (-1 or 1) continually, without a weight applied to the Strain Gauge.

- a) Check input connections to the RCA15 from the Strain Gauge.
- b) If connecting a 4 wire device ensure terminals 1&2 and 5&6 are linked.
- c) Check Strain Gauge output between input terminals 3&4 of the RCA15.
- d) Check that the CALH weight is applied and is not the same or lower than CALL

Display over ranges (-1 or 1) when, or before, the maximum required weight is applied to the Strain Gauge.

- a) Check output of Strain Gauge is set to the correct sensitivity settings on the DIL switch

Display very noisy

- a) If using a 4 wire device ensure terminals 1&2 & 5&6 are linked.
- b) Check output voltage of Strain Gauge.

Display operating in wrong direction

- a) Check connections to input terminals 3&4 are correct way round.
- b) Check the type of Strain Gauge - compression or tension.

Unit will not auto calibrate

- a) Check that CALH is not zero and its weight is greater than CALL.
- b) Check that input is not overranged on CALH weight.

Access to parameters not possible beyond the PASSWORD (PASS)

- a) Check for special password (1111)

2. Relay Output Module

Incorrect Relay Operation

- a) Check set point, in flight and hysteresis values are correct.
- b) Check latching and inversion settings in output action (OA) are correct.
- c) Check connections to output terminals.

Remote function (Auto Tare, Peak Hold / Latched, printer fails to operate)

- a) Check 'DP-r' for correct value to ensure desired function selected.

3. MANTRABUS/ ASCII Format

No Communications

- a) Check that a comms module is fitted.
- b) Check correct CP code is entered for required protocol.
- c) Check connections to RCA15 from IF25 are correct.
- d) Check IF25 green LEDs are on and RX LED is on and TX LED is off.
Press TX TEST , TX LED should light.
- e) Check RS232 connections from the host to the IF25 are correct.
- f) Check SdSt, serial device station number is correct.
- g) Check Baud rate settings on RCA15's are correct for the host.
- h) Check host comms port is set to 8 bit word, 1 start bit, 1 stop bit, no parity.
- i) Check correct protocol is being observed by the host.

Chapter 9 RCA15 Specifications

Strain Gauge Input

Calibration	Automatic digital by use of keypad and 1 (or 2) known weights.
Auto Tare	Auto Tare values can also be viewed and manually changed if required. Auto tare value is retained on power down. Auto Tare is affected from the field terminals.
Sensitivity Range	± 0.05 to 200mV/V (Factory set to nom 2.5mV/V). (DIL Switch Selectable) Preset to $\pm 2\%$
Excitation	9.6V DC nominal, 160mA maximum
Compensation	By \pm sense wires to compensate for cable, connection volt drops and any variation in 10V supply.
Accuracy after user Autocal	90 days $\pm 0.08\%$ of reading $\pm 0.05\%$ of FSD typical
Temp. Drift	0.002% /C typical @ 2.5mV/V
Display Rate	Programmer keypad selectable between 0.1 and 25.6 seconds.
Display Average	Set by programmer keypad, up to 64 standard updates
Input Filtering	Response for 15mV rms at 50Hz signal applied on a 25mV Full Range Input will give 1 part in 1,500 display digit noise.

DC Analogue Outputs

Range	Max Drive	Typical	Accuracy
MIN	Capability	% of reading	% of FSD
+4	20V (1K)	$\pm 0.08\%$	$\pm 0.08\%$
0	2mA	$\pm 0.08\%$	$\pm 0.08\%$

Control / Alarm Relay Output

2 SPCO relays, SP1 and SP2

Contact Rating 50V @ 500mA DC

Set Point, In Flight Compensation, Hysteresis, Latching and Relay Inversion are set digitally using programmer keypad and display, in engineering units.

Hysteresis value applies to both SP1 and SP2. (Fail safe operation by setting inversion to give normally energized operation).

Latching Reset By volt free contact to field terminals or by communication.

The Communications Port Data

Operation

All RCA15 display data can be retrieved via communications port along with relay and EEPROM status.

All RCA15 user configurable data can be changed including EEPROM enable/display and relay reset. (RCA15 Station Number cannot be changed).

The RCA15 communications port provides for a 2 way data link. An intelligent host e.g. Personal Computer, Main Frame or PLC is able to acquire the RCA15's displayed value and read or modify the user configurable parameters, using any of the following:-

- (a) RS232 - for a one to one communication (as in the case of a printer, PC or PLC).
- (b) RS485 - for the connection of up to 25, RCA15 units on a single RS485 line.
- (c) 20mA Current Loop - for up to 250, RCA15 units on a single RS232 line, via the IF25 interface. With high noise immunity and isolation over distances up to 1Km.
- (d) Baud Rates - 300, 600, 1200, 4800,9600, (19,200 Fast Format ONLY)
- (e) Isolation - $\pm 130V$ RMS or DC max to analogue input or any other port.

Protocols available are ASCII and Fast MANTRABUS Format selectable by the CP mnemonic on the display of the RCA15 programmer.

Data Retention and Protection

Retention: 10 years for set values, minimum of 10,000 write cycles, but typically 1,000,000.

Protection of data and function(s): Watchdog timer giving repeat auto resets.
Impending power fail detection and shutdown. Low power detection and hold off.

Environmental

Storage temperature	-20 to +70 °C
Operating temperature	-10 to +50 °C
Relative humidity	95% max non condensing
Case sealing	To IP65

Physical

Rack dimensions	482 x 130 x 185mm
Weight	5.2kg
Terminals	2.5mm, saddle field terminals
Accessibility	All electronics accessible through front panel.

Power Supplies

97 - 120/210 - 260 VAC 50 - 60Hz, 50W

RCA15 Order Codes

Input	Standard Strain Gauge		10V DC / 160mA	
Outputs	Standard Analogue	Output DC voltage DC current	Range 0V to 10V 4 to 20mA	RL1 (Remote programming) <i>or</i> RL2 (Local Display/programming)
Optional Modules				
Communications Port		Current Loop RS232/485		(RC1) (RC3)
Output	Control/Alarm Relay	Output 2 Relays	Function SPCO on SP1& 2	(RR1)
Power Supplies		110 - 120/220 - 240V AC 50 - 60Hz 50W One supply		(RS1)
Program Unit		Remote Hand Held		(LP2)
Rack Mounting		12 x RL1 (Remote Display)		RF1
		8 x RL2 (Local Display)		RF2

Example: (RCA15 - RF2 - 6 RL1 - RR1)

Rack for 6 Local Display modules with Digital Output Modules.

RCA15 Accessories

The following accessories are available to allow for expansion of systems:

	Function	Order Code
IF25 Interface	Connect up to 25 RCA15s NOTE: Details of the unit appears in a separate publication.	IF25
Printers	Time / date and display data Display data only	TDP DP

Instrument Setup Record Sheet

Product
Product Code
Serial No
Tag No
Date
Location
Measurement type, range & engineering units
Communication / Baud Rate

RCA15	VALUE
PASS	
SP1	
IF1	
SP2	
IF2	
HYS	
OA	
CALL	
CALH	
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WARRANTY

All RCA products from Mantracourt Electronics Ltd., ('Mantracourt') are warranted against defective material and workmanship for a period of (3) three years from the date of dispatch.

If the 'Mantracourt' product you purchase appears to have a defect in material or workmanship or fails during normal use within the period, please contact your Distributor, who will assist you in resolving the problem. If it is necessary to return the product to 'Mantracourt' please include a note stating name, company, address, phone number and a detailed description of the problem. Also, please indicate if it is a warranty repair.

The sender is responsible for shipping charges, freight insurance and proper packaging to prevent breakage in transit.

'Mantracourt' warranty does not apply to defects resulting from action of the buyer such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorised modification.

No other warranties are expressed or implied. 'Mantracourt' specifically disclaims any implied warranties of merchantability or fitness for a specific purpose. The remedies outlined above are the buyer's only remedies. 'Mantracourt' will not be liable for direct, indirect, special, incidental or consequential damages whether based on the contract, tort or other legal theory.

Any corrective maintenance required after the warranty period should be performed by 'Mantracourt' approved personnel only.



C In the interests of continued product development, Mantracourt Electronics Limited reserves the right to alter product specifications without prior notice.

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