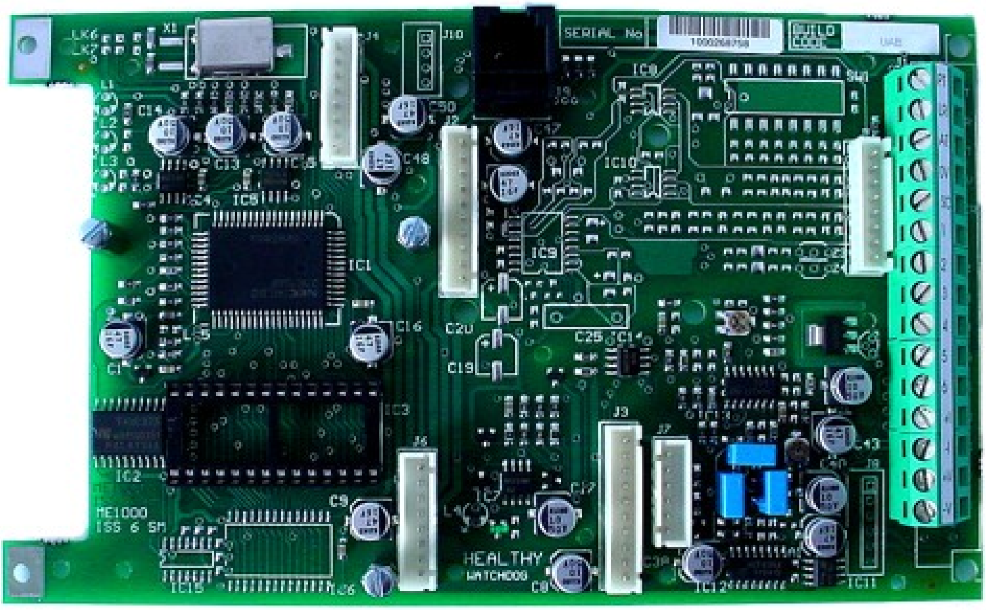

UAB
Universal Amplifier/Digitiser

User Manual
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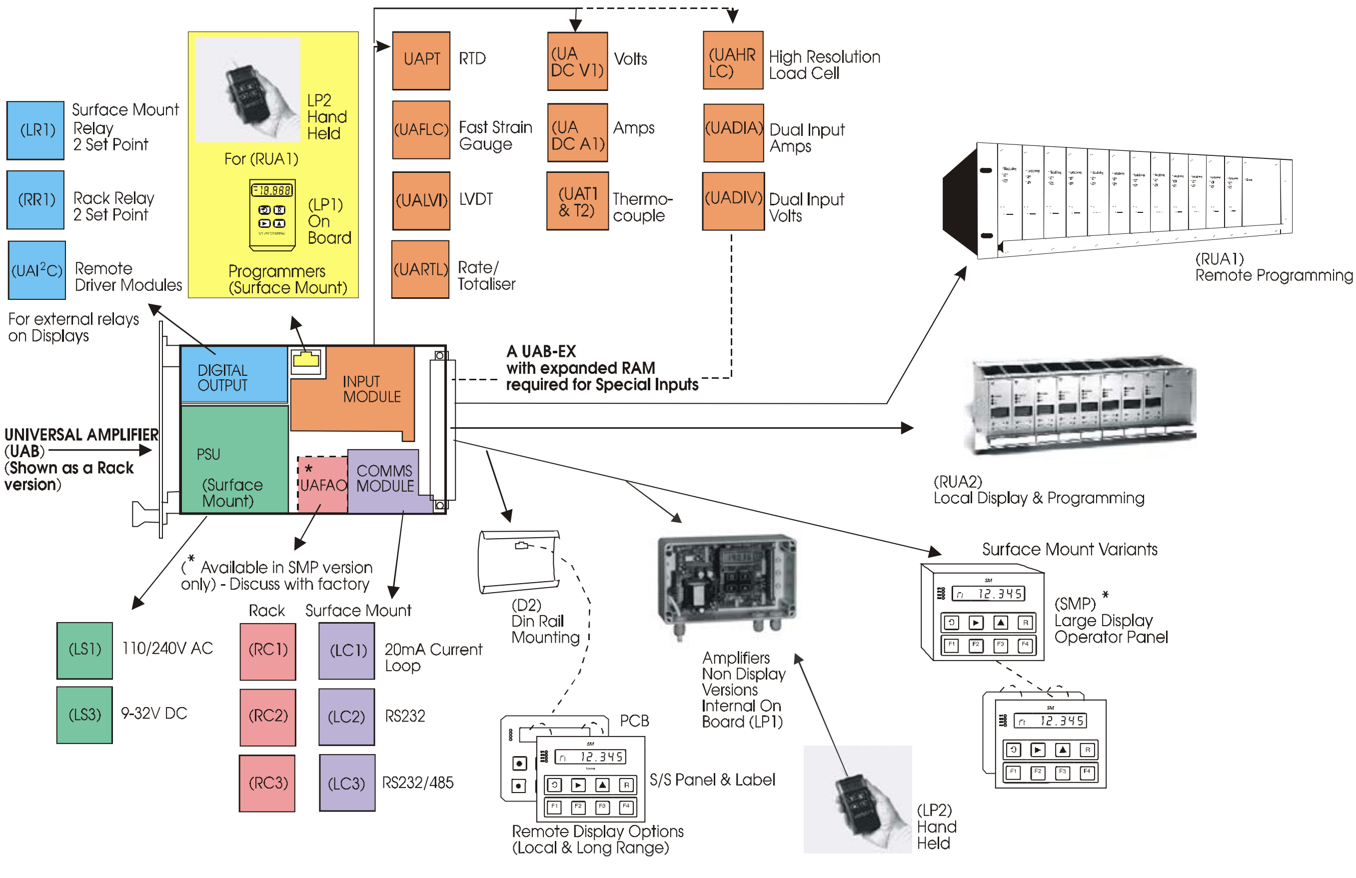
Chapter 1 Introduction To The Universal Process Amplifier System

The Mantracourt Electronics Universal Process Amplifier System is based upon a concept of modular construction. By adopting such a concept, it is possible to offer a great deal of flexibility of construction, to meet the wide and varying needs of system building.
The system is centred on a Eurocard sized amplifier PCB, which consists in its standard form of, Central Processing, and voltage and current Analogue output ports. Facilities are provided to connect a series of ‘plug in ’ option boards for inputs, relay and communications outputs together with mains and low voltage DC power supply options.
A special Fast Analogue output module is also available to complement a Fast Strain Gauge input option.
The modular concept offers the opportunity for assembly in Surface Mount, DIN Rail and 19-inch Rack variants.
The system concept is described in diagrammatic form with the range of options listed. The options will be described under the various Chapters as follows:

1. Introduction
2. Installation requirements
3. Power Supplies
4. Input Modules
5. Output Modules & Communications Information
6. The Amplifier Displays
7. Programming the Amplifier including essential INPUT CALIBRATION ROUTINES, which must be actioned. See Chapter 7
8. Order Codes
9. Specifications



Chapter 2 Installation

In order to maintain compliance with the EMC Directive 2004/108/EC the following installation recommendations should be followed.

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 pin 1 of the input. The screens should not be connected at the transducer end of the cables.

Comms Port: Use individually screened twisted multipair cable. (e.g. FE 118-2117)
The pairs should be:
-Tx & +Tx
-Rx & +Rx
Terminate screens at pin 1 of the input .
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 pin 1 of the input.
The screen should not be connected at the host port.

Pin 1 of the input 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.

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

UAB 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 any one of the following:

220/240V AC, 50/60Hz

or 110V AC, 50/60Hz

or 9-30V DC, 50/60Hz ***(Not RUA)***

Terminal Connections

Connection between the UAB modules and input/output signals, are made via screw connections to the rear of the rack, or edge of the UAB in Surface Mount Versions.
(See Figure 2.1)

Section 1 -The Rack (RUA) Variant

Figure 2.1 - Rear view of Rack (RUA2)

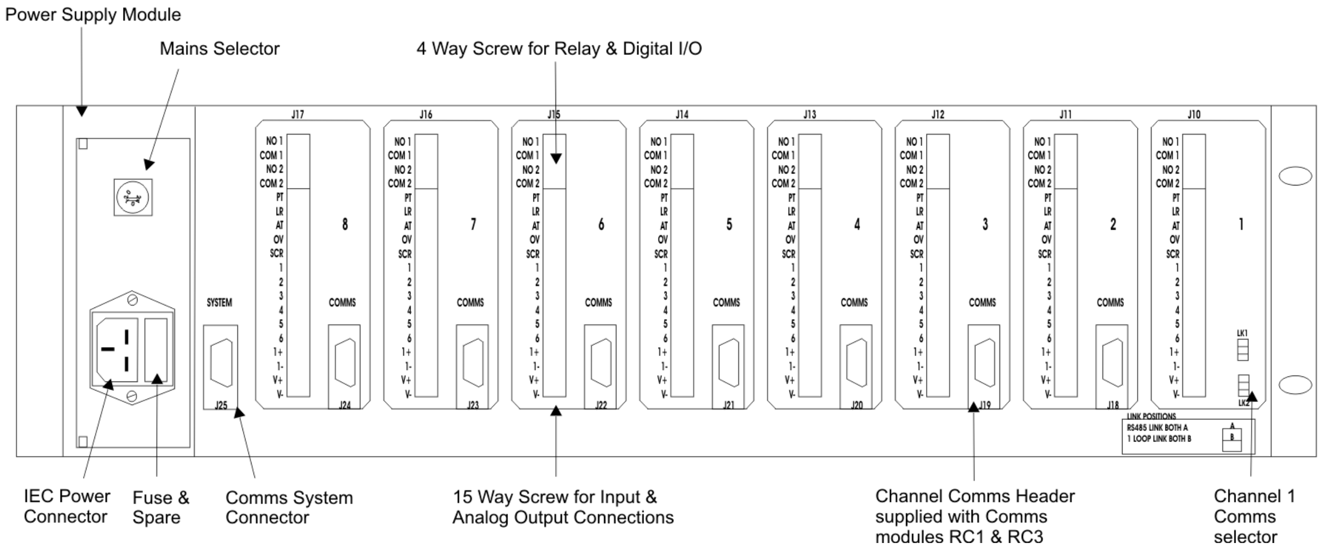


Figure 2.2 UAB Rear Connection Terminals

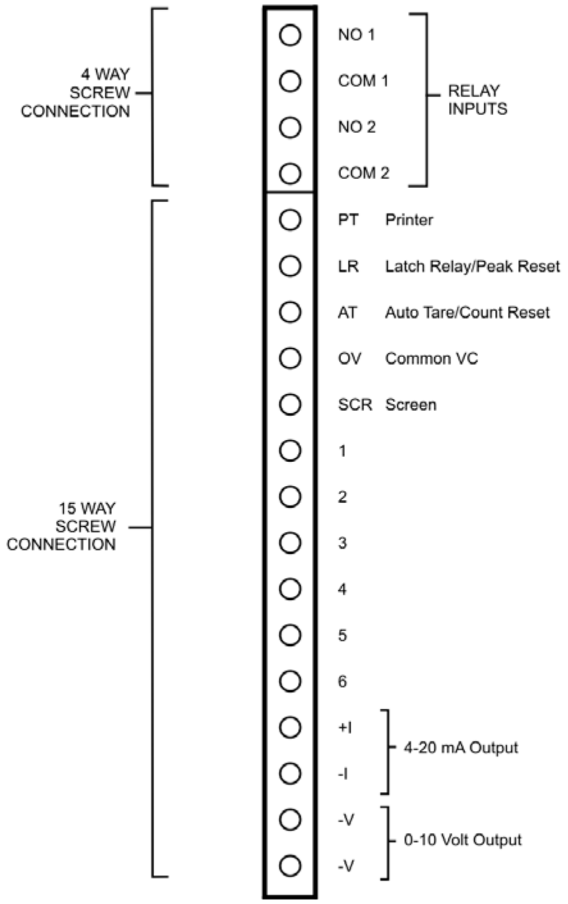


Figure 2.3 The 32 Way A & C (DIN41612) Connections

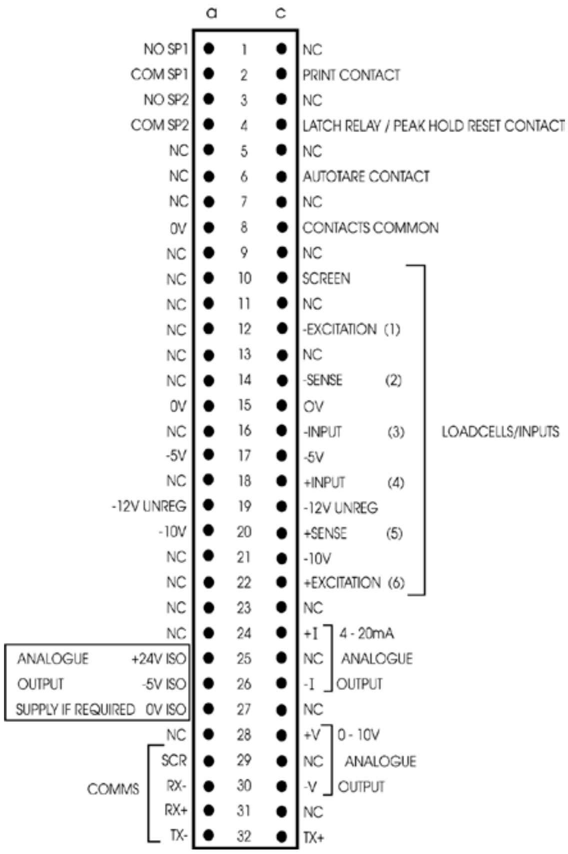


Figure 2.4 Rack Module Layout

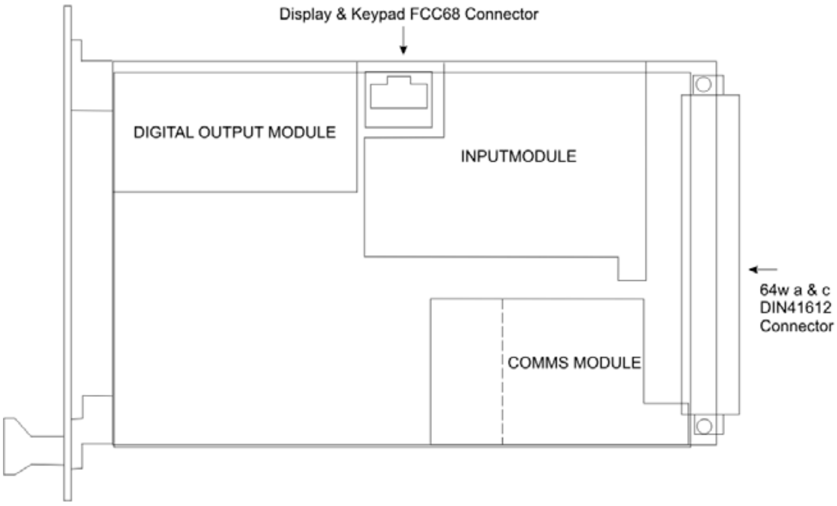
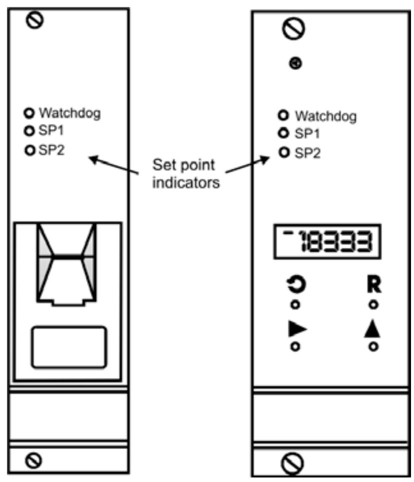


Figure 2.5 LP2 Hand Held Programming Unit

Figure 2.6 RUA1 for External Programmer (LP2)

Figure 2.7 RUA2 On-Board Programmer



Section 2 - The Surface Mount (SMP) Variant

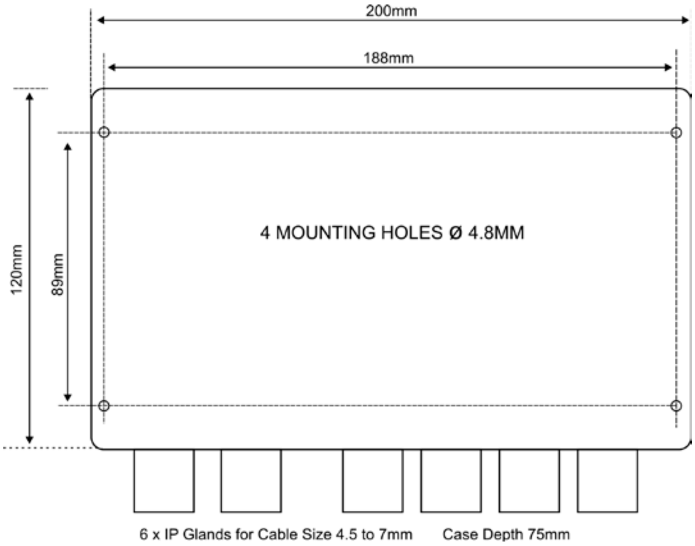
The surface mount variant of the Universal Amplifier is offered in a number of different configurations dependant upon the system installation requirements, to which any of the input, output and communications modules can be fitted as described in the diagram in Section 1. Each description is followed by the order coding for ease of identification.

1. The surface mount IP65 ABS cased version with a large LCD display and programming module mounted in the lid, where local programming and control is required. - (SMP/C).

2. The DIN rail mounted version with a remotely connected large LCD display and programming module fitted with a stainless steel panel mounting fixture which will operate up to 2 metres from the amplifier. (SMP/D) A version of the (SMP/D) above is offered with a driver package (LCDR) where there is a requirement for the remote display and programming module to operate over distances greater than 2 metres, and up to 100 metres from the amplifier. Where order codes are required for individual items, please refer to the order code list in the rear of the manual at Chapter 8.

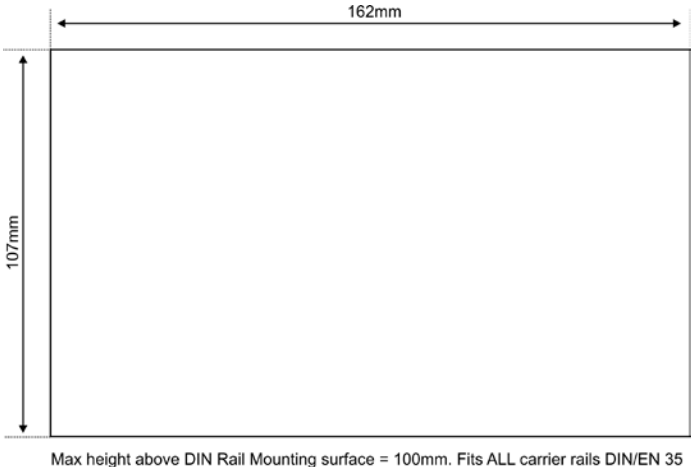
3. ABS Cased Versions are available without a display and programming module mounted on the lid. Programmed through the internal FCC socket on the UAB, (using an LP2 Hand Held Programmer see Figure 2.13) or the remote LP1 On Board Programmer see Figure 2.14

Figure 2.8 The IP65-ABS Case (LAB) Dimensions & Mounting Points



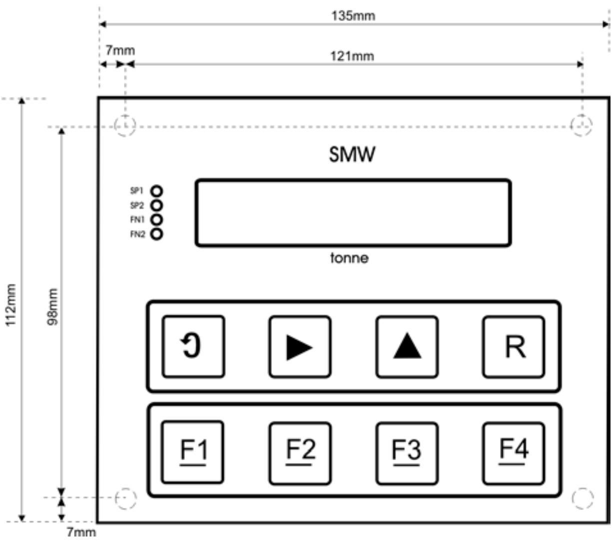
Case Depth = 75mm

Figure 2.9 The DIN Rail Mounting (D2) Dimensions



Max height above DIN Rail Mounting surface = 100mm. Fits ALL carrier rails DIN/EN 35

Figure 2.10 Stainless Steel Panel Mount & Programming Display Module, Dimensions & Mounting Points



4mm M4 studs x 12mm for mounting. Sealing is provided by a Neoprene gasket
For LCD max cable length = 2 meters. For LCDR max cable length = 100 meters

Figure 2.11 LCS Stainless Steel Panel Cut Out

Where there is a requirement for the stainless steel fixture to be mounted in a panel please note the details of the 'Cut Out' are as described in the following drawing.

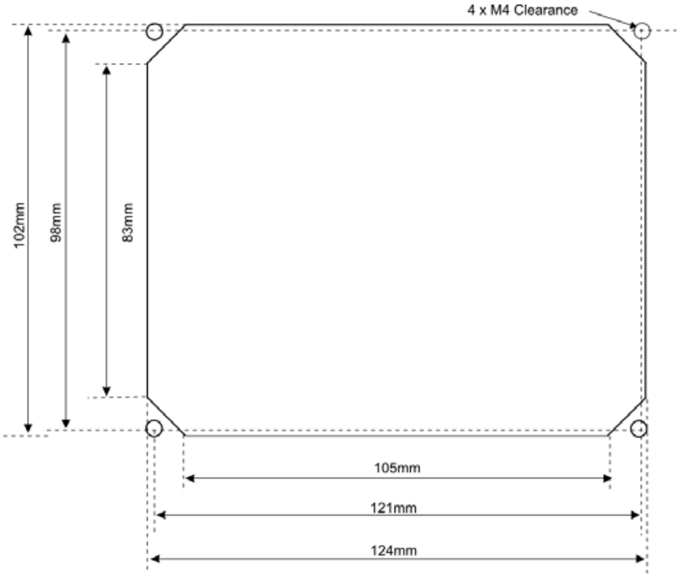
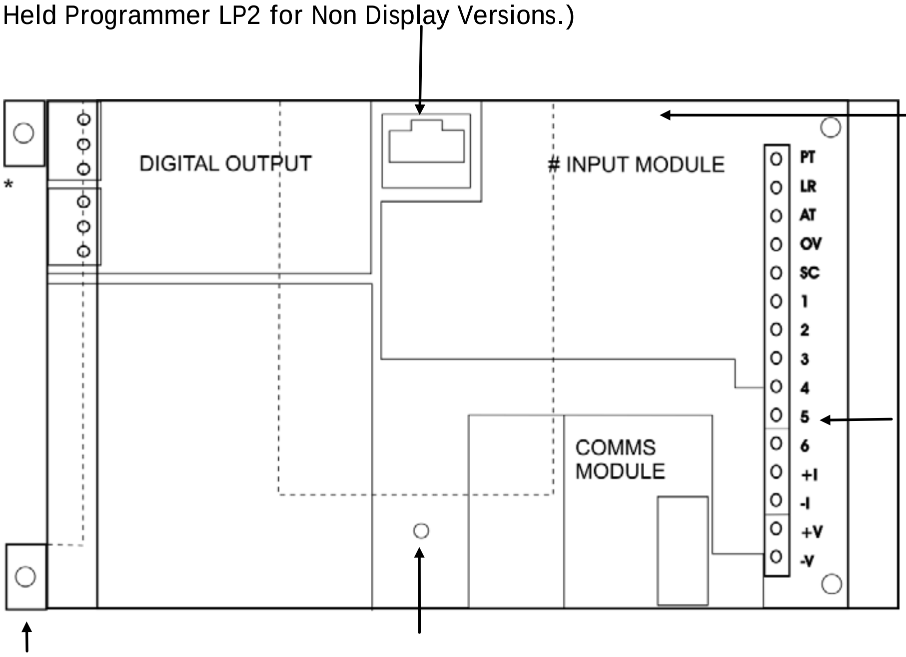


Figure 2.12 Connection & Fitting Details for the Surface Mounted Amplifier (UAB)

Display & Keypad FCC68 Connector (For Surface Mounted Display or Hand Held Programmer LP2 for Non Display Versions.)



The standard (100mS) strain gauge input is contained within the LCB module & therefore has no separate input module

15 Way field screw connection for input, contacts & AN-OP

For DIN mounting cut off PCB on white line

WATCHDOG LED

Programmers for Surface Mount Variants

Figure 2.13 LP1 On-Board Programmer Unit

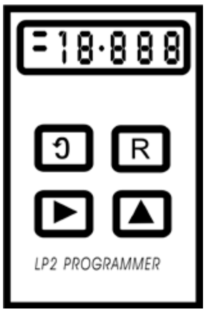


Figure 2.14 LP2 Remote hand Held Programmer Unit (UAB)

Chapter 3 Power Supplies

There are three types of power supply available within the UAB system. The rack versions RUA1 and RUA2 are served by a common power supply, which offers power to the 12 channels in the case of the RUA1 and 8 channels for the RUA2. The Surface Mount versions are offered with mains an AC version or a low voltage DC version.

Section 1 - The Rack Version (RS1)

The RS1 supplies power to the channels within the rack via the common back plane, offering 220/240VAC at 50/60 Hz or 110VAC at 50/60 Hz. The 110/240 is selected by a switch on the rear of the power supply module. A green LED on the front panel indicates when power is applied

A 5-Ampere protection fuse is fitted within the power input socket.

The maximum power rating for a full rack is 100 Watts.

Connection to the rack is made via a flying lead with a shrouded and earthed IEC mains connector

Note: Inputs are not intended to be connected to voltages above 50 VAC or 120Vdc

Tables 3.1 and 3.2 show details of the connections and voltages for the various supply rails.

Table 3.1

PROC-ESSOR SUPPLIES

SUPPLY	CONNECTION TO DIN 41612	MIN V	MAX V	MAX ac V	CURRENT per channel	COMMENTS
0V	15a, 15c	-	-	-	-	Common for processor supplies
-5V	17a, 17c	-4.80	-5.2	1mV	110Ma	Power supply
-14V UNREG	19a, 19c	-11	-18V	150mV	2mA	Used to detect power fail
-9V8	20a, 20c	-9.1	-10.2	1mA	200mA	Provides excitation for stain gauges and relays

Table 3.2

ANALOGUE OUTPUT ISOLATED SUPPLY

SUPPLY	CONNECTION TO DIN 41612	MIN V	MAX V	MAX ac V	CURRENT per channel	COMMENTS
+24V ISO	25a	+20	+32	240mV	32mA	Only required if AN-OP to be used
-5V ISO	26a	-4.75	-5.25	1mV	5mA	Only required if AN-OP to be used
0V ISO	27a	-	-	-	-	Only required if AN-OP to be used

Section 2 - The Surface Mount Versions (LS1 and LS3)

The LS1 power supply is a ‘plug in’ module supplying 110 Volts AC at 50/60 Hz or 220/240 Volts AC at 50/60 Hz.

A maximum power rating of 10 Watts is available, with this module.

The running current for each amplifier is between 250 and 480 milliamps dependant upon module configuration, with a start up current of 3 Amps for 20 milliseconds. Earthing (or shield)- If the amplifier is not earthed elsewhere, an earth should be made to the screen (SC) of the 15 way connector.

Figure 3.1 Power Supply LS1 Connections

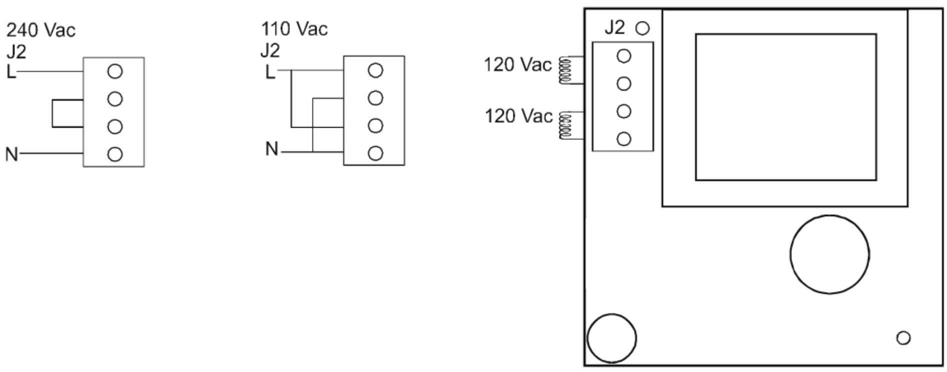
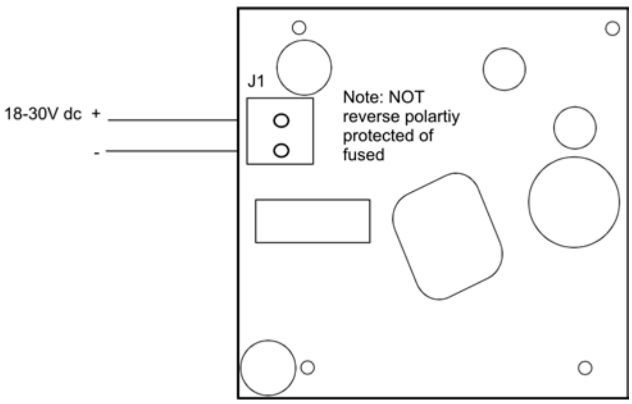


Figure 3.2 LS3 Connections

The LS3 module should be protected on installation by an in line fuse.

The LS3 power supply is a 'plug in' module supplying 9 to 30 Volts DC. Similar in characteristics to the LS1 with regard to power and current ratings.
The module is not reverse polarity protected and will require similar protection at installation.



Chapter 4 Input Modules

The following DC Voltage & Current input modules are available:
-

UADCV1 - **0 to 10 Volts**
UADCA1 - **0 to 20mA**
UADCV2 - **± 200mV**
UADIA - **Dual Input - 4 to 20mA**
UADIV - **Dual Input - 0 to 10 Volts**

Table 4.1 UADCV1 and UADCA1 Switch Configuration

SW1	±200mV	0-10V	0-20mA
1	10V Excite	10V Excite	10V Excite
2	24V Excite	24V Excite	24V Excite
3	5-25V VAR Excite	5-25V VAR Excite	5-25V VAR Excite
4	ON	OFF	OFF
5	OFF	ON	ON
6	OFF	ON	ON
7	OFF	OFF	ON
8	OFF	ON	OFF

Figure 4.1 The UADC1 & UADCA1 Modules

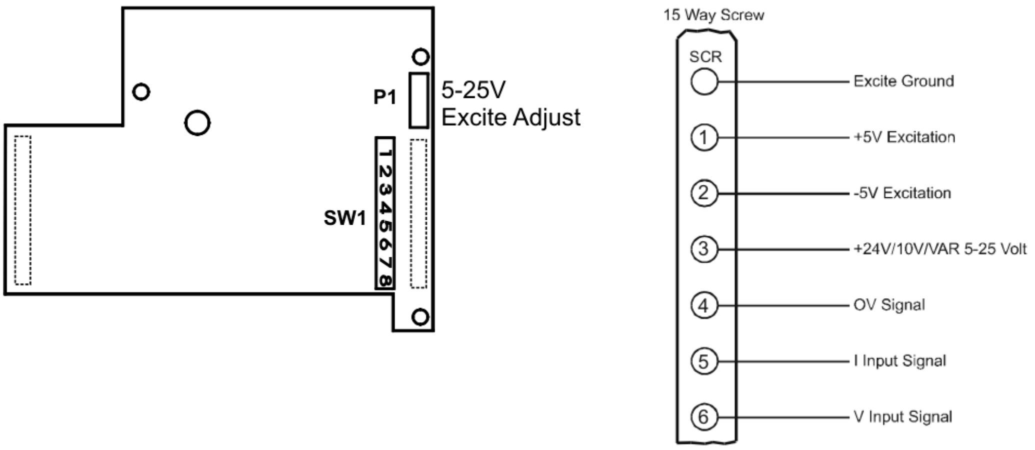


Figure 4.2 The UALV1 - LVDT Module Rear Panel Connections

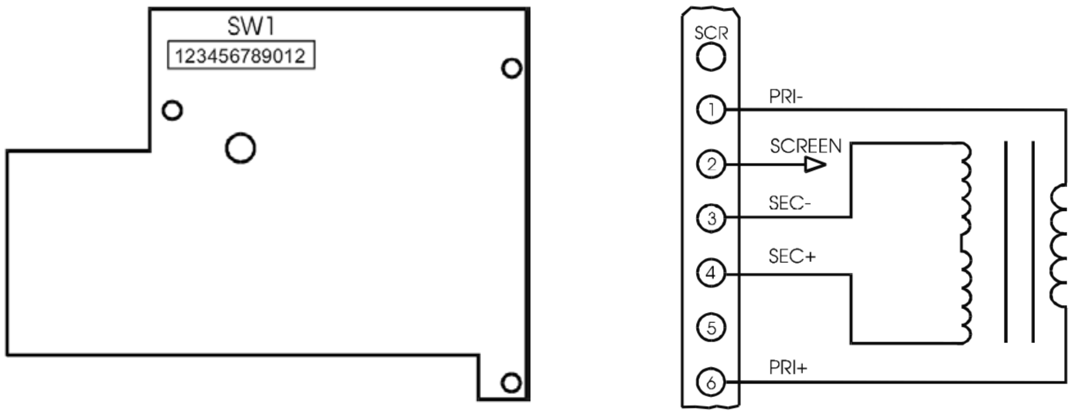
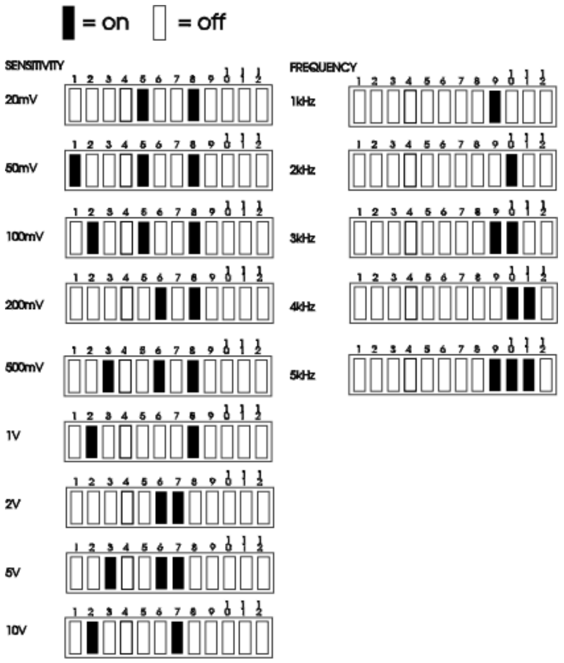
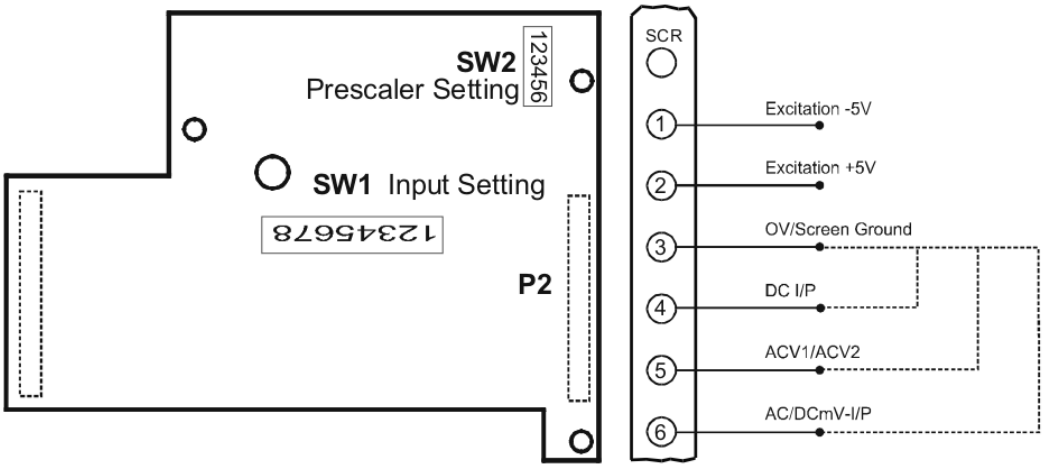


Figure 4.3 LVDT Switch Settings



The UARTL - Rate/Totaliser Module

Figure 4.4 Rear Panel Connections



Note: See Chapter 7 Section 4 for details of input and pre scaler settings.

UAT1 - Thermocouple Type K Modules
UAT2 - Thermocouple Type J Modules

Connecting the Thermocouple

WARNING:
ENSURE POWER IS SWITCHED OFF BEFORE MAKING CONNECTION TO THE UAB

1. Connect the thermocouple to the UAB terminal as shown in Figure 4.6
   Note: If the thermocouple has a floating input, connect terminal 1 to ground.

2. The external cold junction sensor is always connected between input terminals 4 and 6. If no external sensor is used, link terminals 4 & 6.

3. Normally, thermocouple burnout is indicated by upscale over range. If downscale indication is required, link terminals 2 & 3.

Figure 4.5 UAT1 & 2

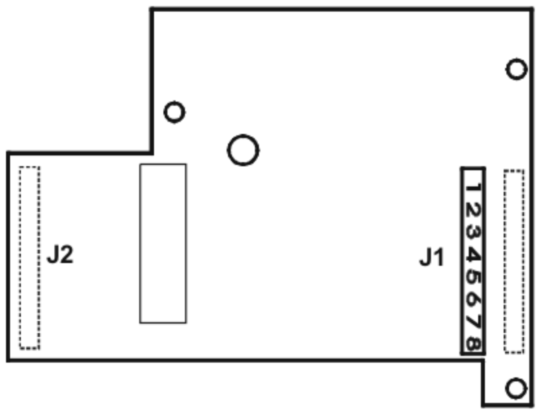
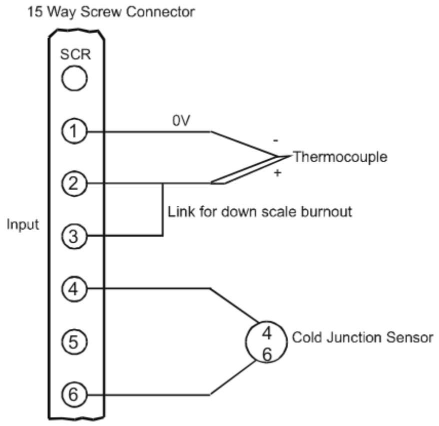


Figure 4.6 Thermocouple Connectors



The UAPT Connecting the Resistance Thermometer Module

Connect the resistance thermometer to the UAB terminals as shown in Figure 4.8 using the terminals appropriate to 2, 3 and 4 wire connections.

Note: It is recommended that 4 core-screened cable be used for this connection with terminal 6 used for screen and ground.
If however, this is not practical, terminal 2 may be used for guard and ground.

Figure 4.7 RTD Module UAPT

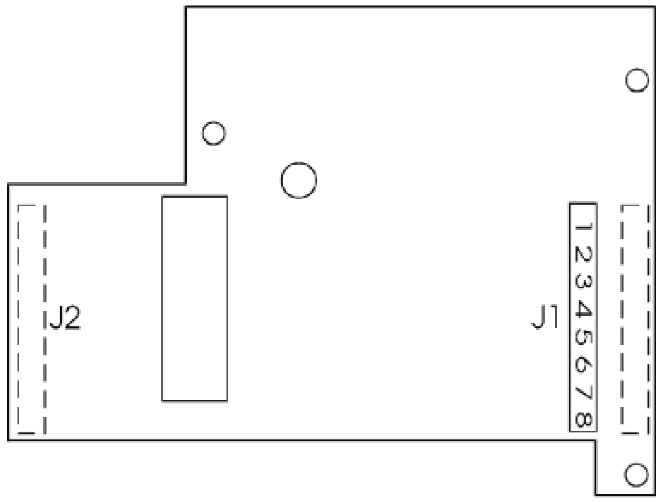
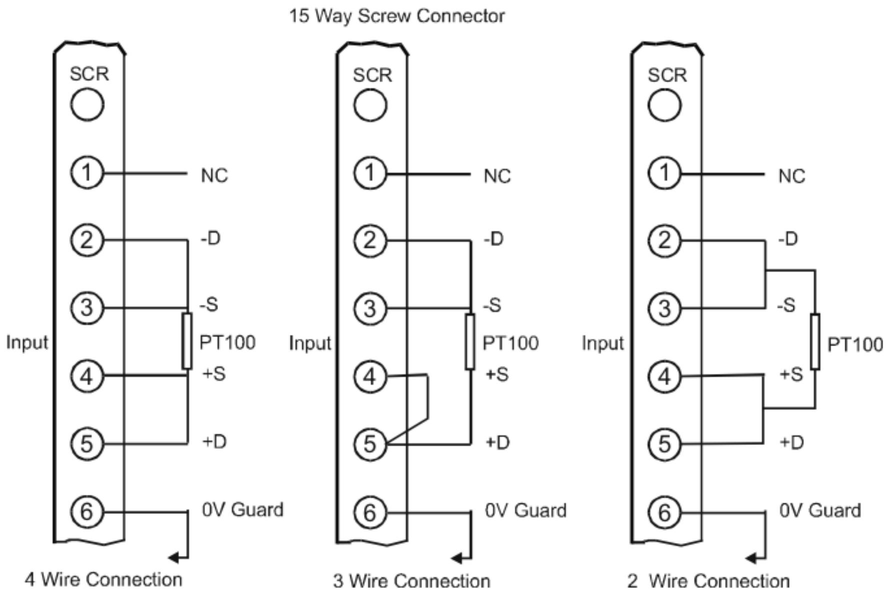


Figure 4.8 RTD Connections



UAFLC Fast Strain Gauge

The UAFLC 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 UAFLC.
The maximum supply current is 150mA, 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.

Note: It is important that the UAFLC is powered up with the strain gauge connected to the input as the A/D performs an Autocal of its own on power up.

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

x = ON - = OFF
mV/V = ±mV/V nominal full range gain within ±3%

Fast Strain Gauge The (UAFLC) Module

Figure 4.9 UAFLC Module

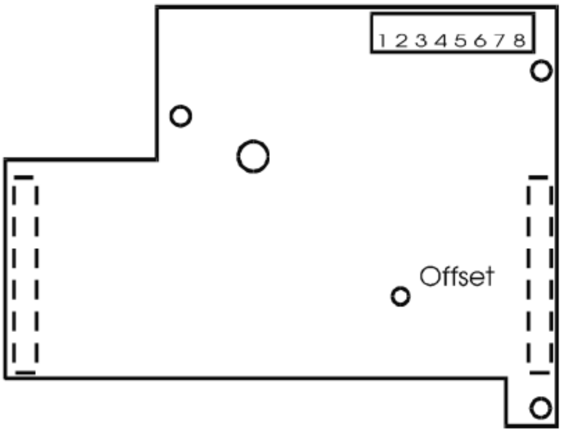
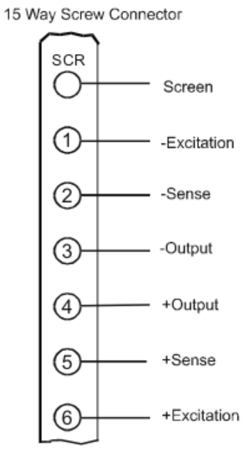


Figure 4.10 UAFLC Connections



Dual Input Modules
Provide two non-isolated inputs either 4 to 20mA or 0 to 10 volts (This should be specified at time of order) as:

- UADIA = 4/20mA
- UADIV = 0/10 volts

These inputs have independent scaling factors IPLA and IPHA for input 'A' and IPLB and IPHB for input 'B'.

The display can be selected from the list of 'A' and 'B' functions as follows, and can be selected under the mnemonic 'Ab'

0 = A + B
1 = A - B
2 = A x B
3 = A/B
4 = A = process input, B = setpoint (SP1)

Scale factors can be applied to this function using a scale factor 'SF', a division factor 'DF' and a display offset 'OFFS'. The analogue output, relays and printer take their value from the function selected at 'Ab'.

Figure 4.11 the UADIA Modules

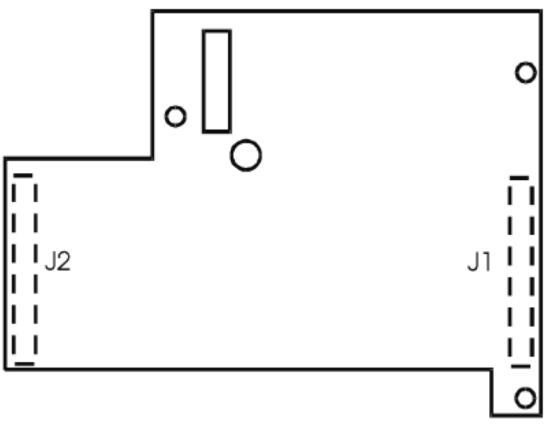
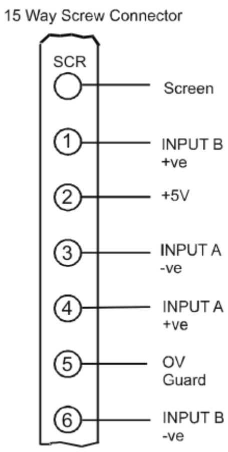


Figure 4.12 UADIA Connections



Chapter 5 Output Modules

Section 1 - General Description

Analogue outputs of 4 to 20mAmps and 0 to 10 volts are standard features and an integral part of the Universal Amplifier pcb.
Further output modules are available offering alarm/control, printer and communications facilities. Analogue outputs are fully scaleable, opto-isolated and digitally generated.
The analogue output signals are generated by the CPU from the displayed input variable, so that output signals are normally related to displayed input values except where the PID function is selected. The 4 to 20 mA output is pre calibrated to an accuracy of within 0.15% of the range. The 0-10V outputs are accurate to within 2% of the 4 to 20mA output.

Notes:
1. Maximum current load on voltage modules is 2mA
2. Maximum drive voltage available in current modules is 20V

The PID function is an option selectable within the standard software program and provides, where required an analogue output so that outputs are related to the PID power levels and not the displayed input signal.
Note: In this mode the analogue output cannot be scaled.

A fast analogue output module (UAFAO) is available for use with the fast strain gauge (10msec) input (UAFLC), where a fast capture facility is a requirement.

The digital output modules consist of two single pole change over relays with ON/OFF or PID control. If required, latching outputs may be selected via the keypad, reset action being achieved by a contact closure or via the communications module, where a program has been written via an appropriate protocol.
Set points and hysterisis are also set via the keypad or from a communications input.
Relay outputs may also be inverted via the keypad.
Relay operations are controlled by set point and hysterisis values, output inversion, time delays or by the PID time proportioning output on set point 1.

Figure 5.1 Showing the Potentiometer for Gain & Offset Adjustment

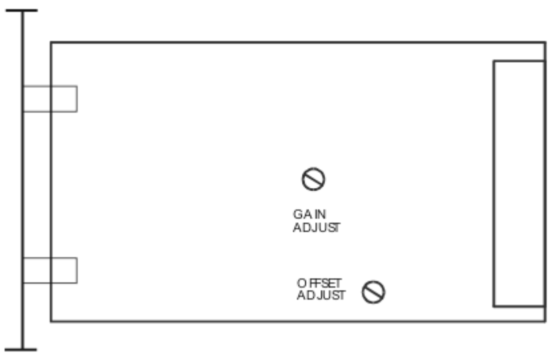
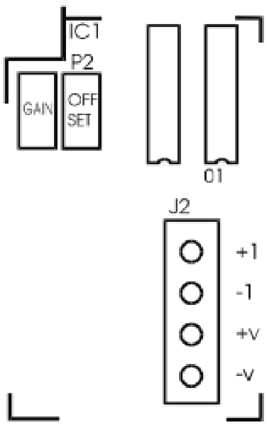


Figure 5.2 UAFAO Connections



Fast Analogue The (UAFAO) Module

Important Note 1: The output action mnemonic OA must be set to 32 when operating with this module.
Important Note 2: When changing the value of OA to, or from '32; it is necessary to power the unit off and back on again as a restart.

See Note with regard to calibrations on Chapter 7 'Method of Calculating OPL & OPH from any known output and Display'

Section 2 - Digital Output Modules

Module Functions

The Universal Amplifier 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 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 energised 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-energised 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.

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.
For programming details refer to Chapter 7 Table 7.15

Latching Output (OL)

The latching facility allows the relay module output to held until the reset externally Latching is applied to the status of the relay SP1 or SP2.
For programming details refer to Chapter 7 Table 7.14

Digital Output Modules -
(LR1) Surface Mount and (RR1) Rack Mount There are two relay modules available, which function in a similar way. The ‘plug in’ module LR1 used with the surface mount version is fitted with relay status LEDs, connections being made directly on to the module terminal block

The RR1, which is used with the rack version, is not fitted with relay status LEDs, these being brought out for observation, to the front of the rack channel. Connections to the module are made to a 4 way field terminal at the rear of the rack channel.

RR1 - 2 SPCO relays, SP1 and SP2

Relay contact rating - 50V @ 500mA

LR1 - 2 SPCO relays, SP1 and SP2,

Relay contact rating - 240V @ 5A AC

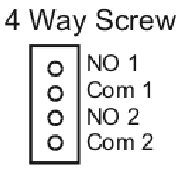


Figure 5.3 RR1 Module

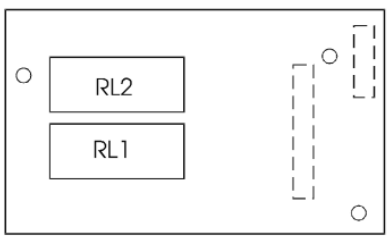
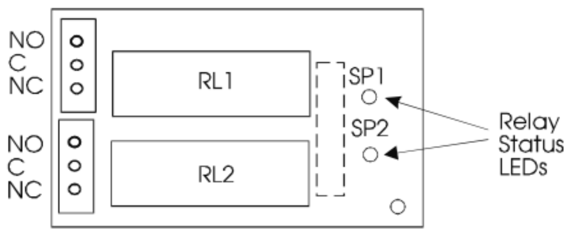


Figure 5.4 LR1 Module



The Remote Driver Modules - UAI ²C
The module offers a general I/O facility for connection to Relays, Real Time Clock and Remote Displays, and is a direct 'plug in' replacement for the RR1 or LR1 Relay Module.

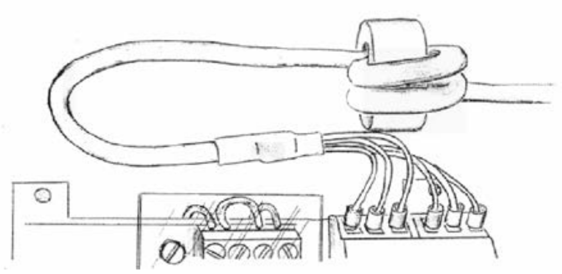
Two versions of the module are available one for the Rack and the other for the Surface Mount versions of the Universal Amplifier Board.

Connection to the Rack version - UA1²C (R)

The Channel 4 Way Screw	**Wire Colour from REMC1**	**Signal**
NO 1	Violet & Yellow	GND
Com 1	Red	+5V
NO 2	Black	CLK
Com 2	Blue	DATA

Connection to the Surface Mount/DIN Rail version - UAI ²C(S)

Figure 5.5 Installation of LR1

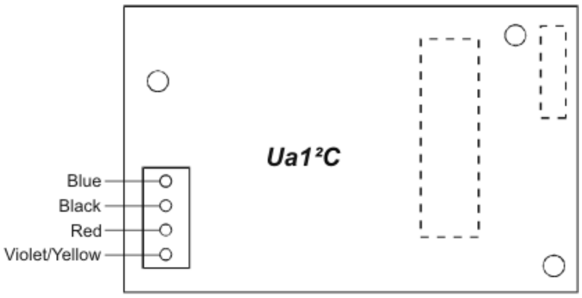


To meet the Specified EMC Fast transient requirements it is important that the ferrite ring supplied is fitted as per the following instructions.

Illustration showing ferrite ring FEC 323-4940 fitted to the LR1 relay wiring.

Two turns of the wiring are passed through the ring positioned 12cm from the LR1 end of the cable to improve immunity to electrical fast transients and bursts.

Figure 5.6 Connection to the Surface Mount/DIN Rail Version UAI²C (S)



Section 3 - The Communications Port Modules

A series of communications modules in both surface mount and rack versions, provide for two way data links to an intelligent host such as a Personal Computer, Main frame or PLC, which are able to acquire displayed values and read or modify the user configurable parameters, using any of the following: -

A 20mA current loop usually connected through an IF25 current loop to RS232 interface unit for multiple amplifier connection. - (LC1) for the surface mount and (RC1) for the rack version.

An RS232 for a one to one communication, usually where a printer connection is required. (RC2) for the rack version.

A RS232/485 (link selectable) for one to one or multi-drop applications - (LC3) for the surface mount and (RC3) for the rack version.

Three communication formats, FAST MANTRABUS, ASC11 and PRINTER are selected from the mnemonic CP via the keypad of the display/programmer.

Integrity is ensured by pre-programmed default parameters, should a loss of communications with the host unit occur.

Connection and Baud rate setting details are shown in the following module diagrams: -

Figure 5.7 LC1 Current Loop

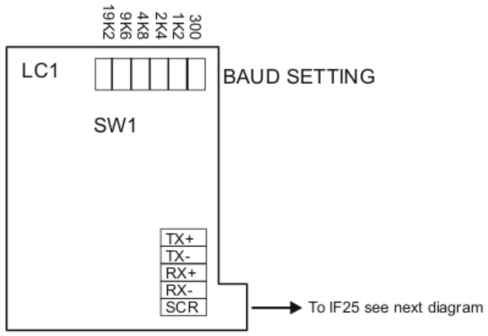
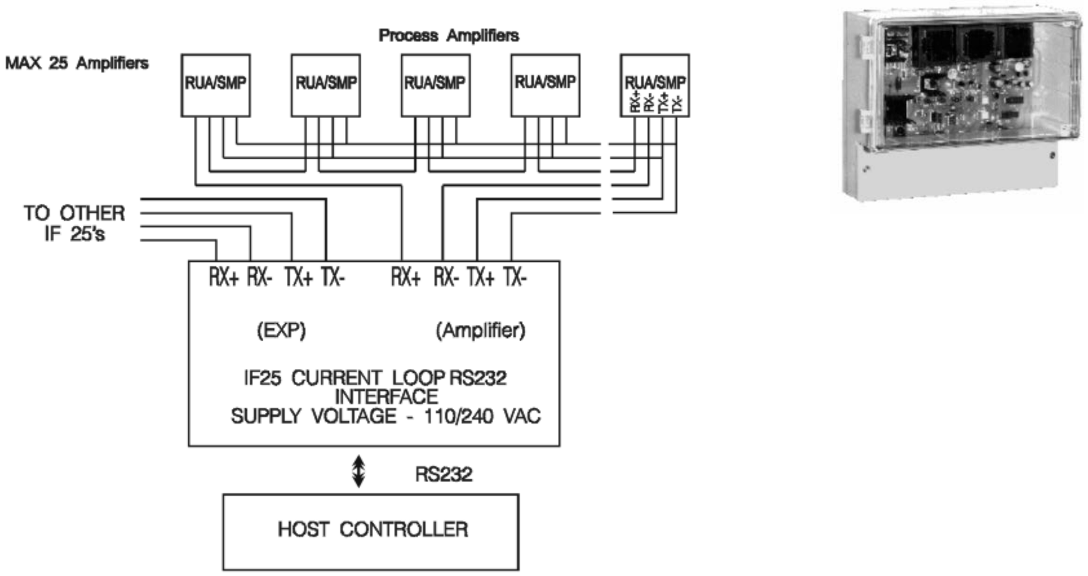


Figure 5.8 IF25 Connecting Multiple Process Amplifiers



Connecting Multiple Process Amplifiers to the IF25 Interface
Notes

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

LC3 Isolated RS232/485 Communications Module

Figure 5.9 LC3 Isolated RS232/485~Mode Connections

Note: When multi dropping in RS485 mode, the last device should be fitted with LK2, which acts as a 120R-terminating resistor.

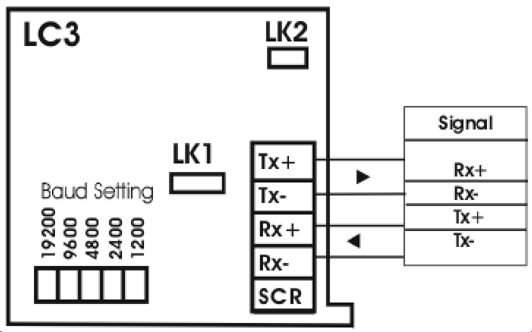


Figure 5.10 Connecting Multiple Units on RS485

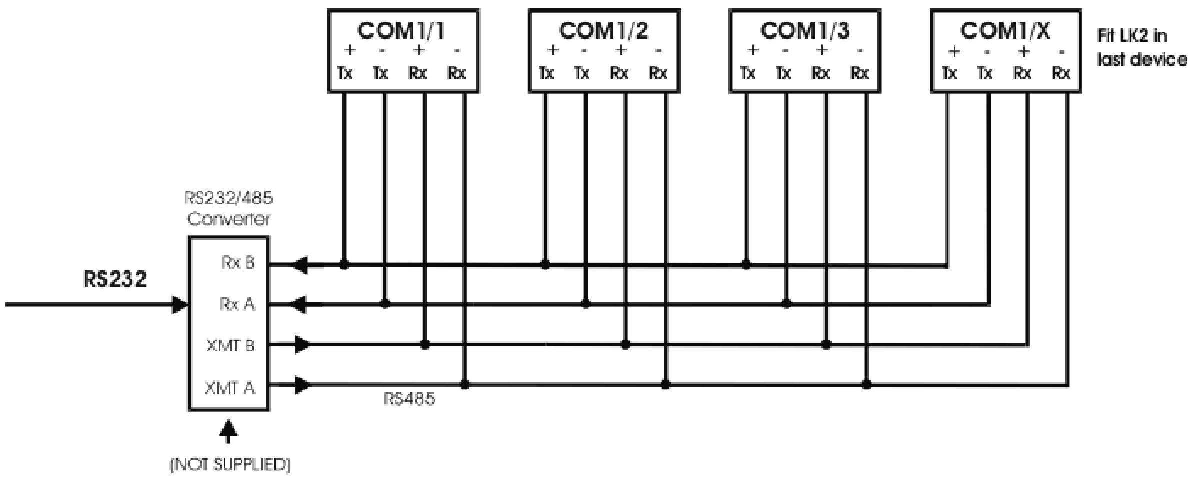
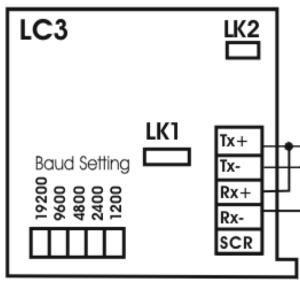


Figure 5.11 LC3 RS232 Mode Connection to PC

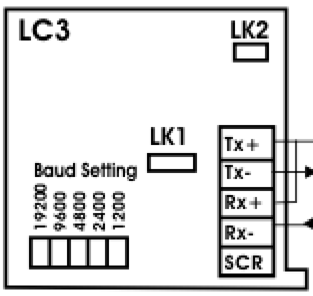
Note: LK1 must be fitted for RS232 operation



Signal	9 Way 'D' Skt	25 Way 'D' Skt
GND	5	7
Rx	2	3
Rx	3	2

Figure 5.12 LC3 RS232 Mode Connection to Printer

Note 1: LK1 must be fitted for RS232 operation
Note 2: If no RTS is available from the printer, fit LK2



Signal	ITT-Ipp-144 -40E	Amplicon AP24/AAP40
GND	1 & 5	15
Rx	2	3
RTS	8	P

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

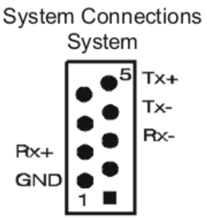
2. Fit a 1.5K from the receive negative to the receiver +5V supply, or a 3K3 to the +12V supply.

3. Fit a 1.5K from the receive positive to the receiver supply Ground.

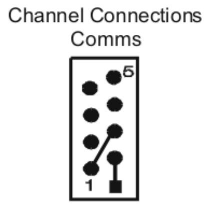
RC1 Communications Current Loop Module Connections

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, apart from Channel 1, which is terminated by links, LK1 & LK2 on back plane.

Figure 5.13 RC1 Communication Connections



9 way 'D' type socket with (RED) identifier



9 way 'D' type socket (BLUE) for channels 2-12 supplied with RC1

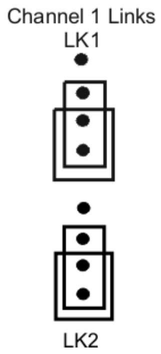


Figure 5.14 RC1 Baud Rate Selection

Baud rate is selected by a link header (SW1)

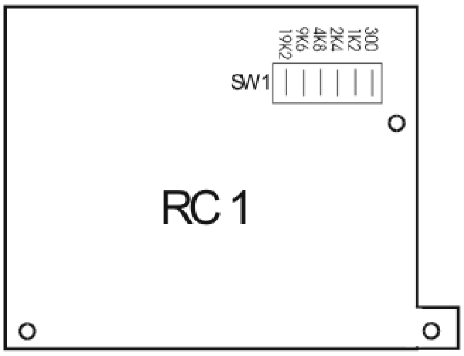
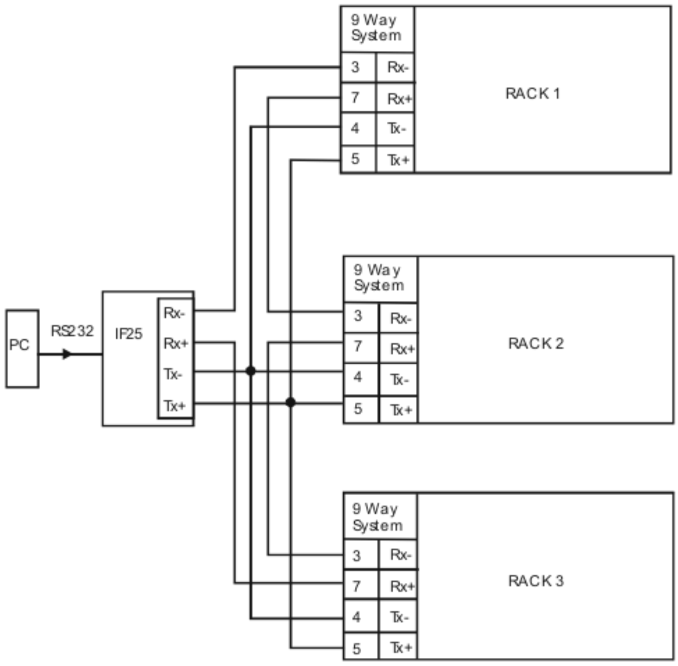


Figure 5.15 Connecting Multiple Process Amplifiers

IF25 To Multi Rack System



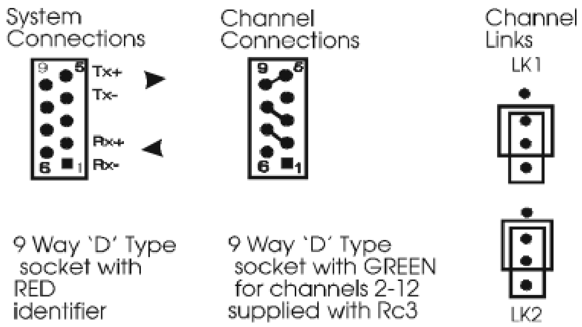
Notes:
1. Maximum loop voltage is 50V dc.
2. Loop is isolated from host and RCA15s. Loop should be earthed via Rx - on IF25/254
3. IF25 used for up to 25 RCA15s.
4. At 19,200 Baud, max. cable length is 100m meters, using cable type BICC H8085.

RC3 RS232/485 Communication Connectors

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 5.16 RC3 RS232/485 Communication Connections

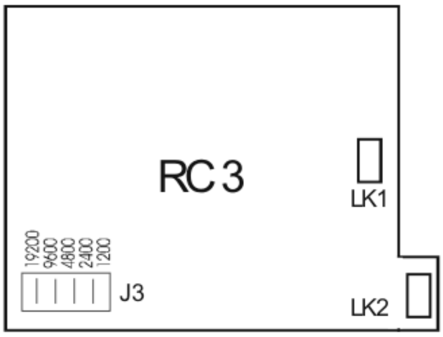


Note: The last device may be terminated by 120R resistor by fitting LK2 on RC3 module.
LK1 on RC3 must **not** be fitted for multi-drop applications.

Figure 5.17 - 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.

Section 4 Serial Communication Protocol

General
Incoming data is continually monitored by the Process Amplifier on its serial input line. Each byte of data is formatted as an eight bit word without parity, proceded 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 - 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 Process Amplifier keypad under mnemonic SDSt and ranges from 0-254). The Process Amplifier 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 Process Amplifier. 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 Process Amplifier 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 Process Amplifier 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 Process Amplifier variables, thus changing parameters such as Set Points, in flights etc.
An acknowledgement message is returned to the Process Amplifier to indicate that the new data has been acted upon.

Updating
The station number followed by the command byte determines the required mode or variable to be updated. 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 preceding the checksum must have its most significant bit set to signify the end of data.
The Process Amplifier 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 Process Amplifier.

Command No.

DEC	**HEX**	**Description**	
1	1	REQUEST ALL DATA INCLUDES PROCESS VARIABLE INPUT	
2	2	REQUEST DISPLAY DATA	
3	03	SET POINT 1	SP1
4	04	SET POINT 2	SP2
5	05	HYSTERESIS	HYS
6	06	OUTPUT LATCH	OL
7	07	OUTPUT MODE SELECT	OA
8	08	PROPORTIONAL BAND	PB
9	09	INTEGRAL TIME	IT (ont)
10	0A	DIFFERENTIAL TIME	DT (oFFt)
11	0B	CYCLE TIME	CT(da)
12	0C	INPUT LOW	IPL
13	0D	INPUT HIGH	IPH
14	0E	OUTPUT LOW	OPL
15	0F	OUTPUT HIGH	OPH
16	10	INPUT RANGE SELECT	IP
17	11	DECIMAL POINT POSITION	DP-r
18	12	STATION NO.	SDSt
19	13	EEPROM ENABLE/DISABLE FLAG	-
20	14	OUTPUT RELAY RESET	-
21	15	TOTALISER COUNT RESET	-
22	16	PEAK HOLD RESET	-

Command 1 Request for All Data:

Data Transmitted To Process Amplifier 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 Process Amplifier whose Station number is 47 send the following Data:-

0FFH, 02FH, 081H, 0AEH

Note MS Bit Set

Response to Command 1 From Process Amplifier

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 Process Amplifier

Command 2 Request Display Data

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

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

0FFH, 02FH, 082H, 0ADH

Note MS Bit Set

Response to Command 2 from Process Amplifier

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 Process Amplifier then the Not Acknowledgement string is transmitted by the Process Amplifier.

Commands 3 To 18: Write data to Process Amplifier parameter

Commands 3 to 18 all have the same format. Format for data transmitted to Process Amplifier 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 a Process Amplifier whose station number are 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 Process Amplifier then the following acknowledgement string is transmitted by the Process Amplifier.

Station number, 015H (NAK)

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

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 Process Amplifier 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 Process Amplifier 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 Process Amplifier 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 Process Amplifier 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 Process Amplifier for Command 20

OFFH, Station number, 094H, CHKSUM

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

0FFH, 02FH, 094H, 0BBH

Note MS BIT SET

For response by Process Amplifier see 'Response to Commands 3 to 22'

Command 21: Auto Tare
DATA transmitted to Process Amplifier for Command 21

OFFH, Station number, 095H, CHKSUM
Where CHKSUM = Station Number EXOR with 095H Example: To output an Auto Tare command to an Process Amplifier whose Station Number is set to 47
0FFH, 02FH, 095H, 0BAH

Note MS BIT SET
For response by Process Amplifier see 'Response to Commands 3 to 22'

Command 22: Peak Hold Reset
DATA transmitted to Process Amplifier for Command 22

OFFH, Station number, 096H, CHKSUM

Where CHKSUM = Station Number EXOR with 096H Example: To output a Peak Hold reset to an Process Amplifier whose Station Number is set to 47
0FFH, 02FH, 096H, 0B9H

Note MS BIT SET

For response by Process Amplifier see 'Response to Commands 3 to 22'

Example of a Basic Code to Communicate with 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$;
(must add semicolon after string to stop transmitting a carriage return)
wait for a while (this depends on how many bytes you are expecting and the baud rate!)
input all the bytes in the serial buffer
input.from.uab$=INPUT$(LOC(1),#1)

ASCII Format - selected when CP is 129
The serial data to and from the Process Amplifier 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 Process Amplifier 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', i.e. which variable in the Process Amplifier is to be acted upon. If the label is received incorrectly and cannot be decoded the Process Amplifier will return a '?' followed by a C.R. character. If the received label is followed by a C.R. the Process Amplifier will return the current value of the variable in question. ***Because there is no hardware handshaking, all transmission from the Process Amplifier 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 Process Amplifier a prompt character is required from the host.*** The output from the Process Amplifier 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 Process Amplifier 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 Process Amplifier 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 Process Amplifier			**Data returned from Process Amplifier**		
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 Process Amplifier		**Data returned from Process Amplifier**
CR xxx	SP1 = 100.0	CR
Station No..label	numerical value	
CR xxx	SP3 = 100.0	?CR
Station No.,	incorrect label numerical value	

Table 5.1

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

Process Amplifier Printer Format

(CP must be set between 0 - 127)
Printer selection enables the Process Amplifier 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 Process Amplifier communications port and the printer with a maximum cable length of 100 meters. (See Chapter 5 Figure 5.11 for Details)

All standard Process Amplifier 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**
05.03.2007 05:06

2 Prints a sequential log number, current display, unit of measure with customer text message No 1
e.g. **MANTRACOURT ELECTRONICS PROCESS AMPLIFIER 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 PROCESS AMPLIFIER PRINTER**
00013 0023. tonne
05.03.2007 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).
12 LOG NUMBER, THE DISPLAY VARIABLE & a LABEL (not zero)
127 ASCII string on print command
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	14 mm	28 %RH	42 uS	56 mV DC
1 Deg R	15 Wh	29 gram	43 Ohms	57 A DC
2 Deg C	16 Db	30 kg	44 m/s	58 mA DC
3 Deg F	17 tonne	31 lb	45 ft/min	59 V AC
4 Kelvin	18 m	32 kWh	46 RPM	60 mV AC
5 lb/in 2	19 in	33 mile/h	47 RPMx10	61 A AC
6 bar	20 ft	34 %	48 RPMx100	62 N
7 mbar	21 degrees	35 ton	49 cos @	63 spare
8 kPa	22 L/s	36 %Dev	50 km/h	64 spare
9 atm	23 L/min	37 W	51 ms	65 spare
10 mmHg	24 L/h	38 kW	52 RPM1000	66 spare
11 inHg	25 gals/s	39 MW	53 Hz	67 knots
12 inH2O	26 gal/min	40 pH	54 kHz	68 s
13 cmHg	27 gal/h	41 ppm	55 V DC	

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 6 The Amplifier Displays

A range of display /keypad variants are offered to accommodate both surface mount and rack versions of the Process Amplifiers.

Rack Amplifiers

The two versions of the rack amplifier RUA1 and RUA2, have different display fixture requirements. The RUA1 is provided with an FCC type shuttered socket on the front of each channel, into which a hand held programmer (LP2) is inserted and latched and which can be removed, once programming is complete. In common with all amplifier displays a 4.5 digit LCD display and keypad is provided to allow for common programming procedures.

The RUA2 is fitted with an On-Board front panel mounted display and programming facility of similar layout to the (LP2). However in this case the programming is achieved by inserting a probe through the 2.2mm holes in the front panel.

Figure 6.1 Programmer Unit Panel Layout (RUA2)

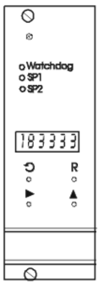


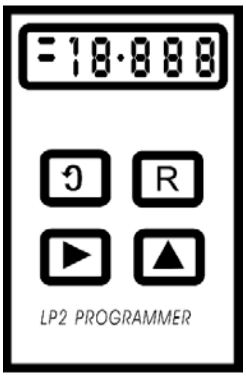
Figure 6.2 LP2 Remote Hand Held Programmer Unit

When in the programming mode, a Flashing bar symbol '-' is indicated in the top left hand corner of the display.

Surface Mount Amplifiers

A security link option on the rear of the display pcb, is available to prevent the change of data where required. Where surface mount amplifiers are used, options are available to program with the (LP2), from the FCC socket mounted on the main pcb, or by fitting an On-Board display module (LP1) with nylon stand off pillars, onto the main pcb, using the same FCC socket. The layout of the keypad remains similar throughout.

Figure 6.3 Programmer Unit Panel Layout (LP1)



Control Panel Guide

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 might 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.

Selects the display digit required. Selection value is indicated by a flashing digit and flashing program indicator.

Increments each selected display digit 0-9.
Pressing the ▲ key under programming conditions will display the leading digit as either 1, -1, or a blank display for zero.
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.

A Large Keypad Panel Mount Display is also available which can be mounted to the lid of the ABS case of the surface mount amplifier, or with the necessary driver hardware, can be fitted to a stainless steel panel and used remotely.

Figure 6.4 Programmer Unit Panel Layout

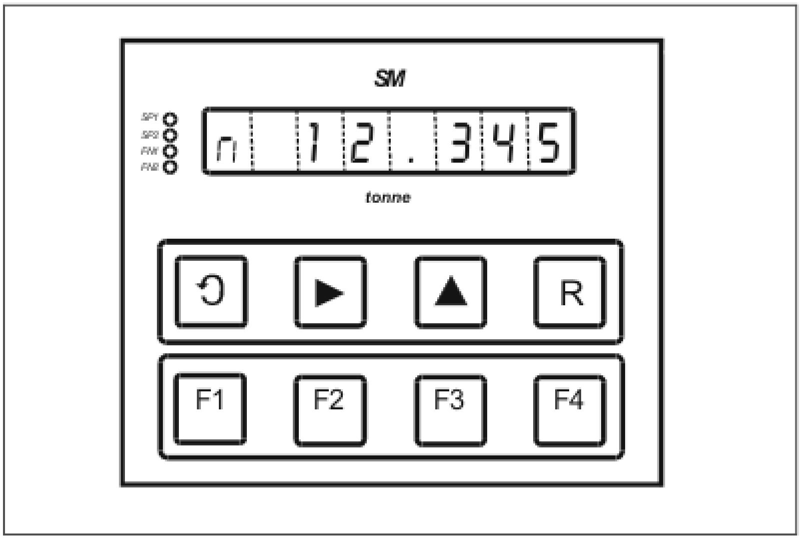


Figure 6.5 Display Module Connections and Switch Settings

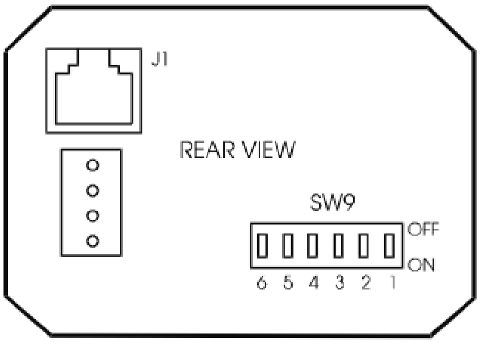


Table 6.1

Position ON	**Function**	**Factory Settings**
1	Enables Keys [▶] and [▲]	ON
2	Enables *all* Program Keys [↺] [▶] [▲] & [R]	ON
3	Enables [F1] and [F2] Function Keys	ON
4	Enables [F3] and [F4] Function Keys	ON
5	Forces display to always be GROSS VALUE *only*	OFF
6	Forces display to always be NET VALUE *only*	OFF

Chapter 7 Programming The Amplifiers

Section 1 - Display & Programming Mnemonics

As described in the previous chapter, there is common symbol and keypad layout for programming all the variants whether it be rack or surface mounting units.

Table 7.1 Configurable Parameters for Process Input

The standard range of programming mnemonics is show in the following table: -

Display Function (In order of Display)		**Range**	**Function**
PASS	1111	±19999	Security Password. Correct value required proceeding further (special numbers on request).
			Password for Analogue Input Calibration routine giving
		2000	access to:
			A to D Calibration Low value
		ADCL	A to D Calibration High value
		ADCH	Sets first output trip or control
SP1	Set Point 1	-19999 to +19999	(Chapter 5 refers)
SP2	Set Point 2	-19999 to +19999	Sets second output trip or control (Chapter 5 refers)
HYS	Hysteresis	0 to +19999 in real display units	Sets hysteresis applied to SP1 and SP2 when used for ON/OFF control units (Chapter 5 refers)
OL	Output Latch	Latch set by code in range 0-3 as shown in Table 5.1	Allows SP1 and/or SP2 to be latched until reset externally, from the keypad or via communications port.
OA	Output Action (Inversion) of SP1 & SP2	Action set by code in range 0-15 as shown in Table 5.2	Sets output relay action. Can be set to 'normal' or 'inverted' operation for either or both set points. Gives fail safe operation of any alarm combination, High-High, High-Low, Low-High & Low-Low. (Chapter 5 refers) Also selects whether analogue outputs controlled by display module or PID element in CPU Inversion of the analogue output.

Pb	Proportional Band	0 to 1024	'O' Selects 'Ont'.'Offt' or 'da' function 1-1023 Selects PID mode and value of proportional band, in displayed units. 1024 Selects Integral 'It' only control
Ont	Output on delay	0 to 255	When PID is not used, (PB=0) the mnemonic (Ont) sets a delay on time for SP1 & SP2. Set in seconds. *Or*
(It)	Integral	0 to 6000	Selects integral value for PID control in seconds/repeat. 0= Proportional only control.
OFFt	Output off delay	0 to 255	When PID is not used, (PB=0) the mnemonic (Offt) sets a delay off time for SP1 & SP2 set in seconds. *Or*
(dt)	Derivative Time	0 to 255	Selects derivative value for PID control. 0 = OFF (no derivative)
dA	Display Averaging & Peak Hold	0 to 15	When PID is not used, (PB=0) the mnemonic (dA) sets a display averaging update rate. Readings may be averaged over a number of updates and can be set as follows: Display update time 0 = 1 readings (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. 0.1S A peak hold function, which will display the highest recorded value of the measured input, can be set by adding 8 to any of the above settings. To reset Peak Hold press the ▶ key, then within 1 second, press the ▲ key. Can also be reset externally or via comms. **Or**
(ct)	Cycle time	1 to 255	Set time in seconds for one complete power cycle output of PID power (time proportioned through SP1).
IPL	Input Low	-19999 to 19999	For linear analogue inputs, used to set the required display reading when an analogue input is at its minimum value. Also provides an OFFSET for value for non linear analogue Inputs.*Or*
(IpOf)	Offset Factor	-19999 to 19999	For rate/totaliser inputs, the value provides an offset or for totaliser, a count reset value.
IPH	Input High	-19999 to +19999	For linear analogue inputs, used to set the required display reading when an analogue input is at its maximum value.*Or*

(IpSf)	Scale Factor	0 - 1.9999	Applies a variable gain to the rate /totaliser reading 1.0000 for unity (0.5000 to halve the display value.)
OPL	Output Low	-19999 to+19999	Used to set the display value at which the minimum analogue output is required.
OPH	Output High	-19999 to+19999	Used to set the display value at which the maximum analogue output is required.
IP	Input Select	0 to 65	Used to set up the UAB for the input to be monitored. (See Sections 2-4 of this Chapter)
dP-r	Decimal Point & Reset	range 0 to 61 Code dP Position 0 19999 1 1.9999 2 19.999 3 199.99 4 1999.9 5 19999.	To set the required position of the decimal point on the display and to set the rear contact actions for count reset &/or peak hold &/or latched relay reset &/or print. Or any combination of these. To make reset input active on any or all of the following add to dP-r No. as follows:
		8	Reset totaliser count
		16	Reset latched relays or peak hold
		32	Activate print
		(Note: Latched relays are not available with peak hold)	
cP	Comms Protocol	0-129	Comms Protocol (see Chapter 5) (0 to 127 = Printer 127 = Continuous ASCII stream of display data transmitted on every display update. 128 = 'Fast' MANTRABUS 129 = 'ASCII'
SdSt	Serial Device Station	Set by code in range 0 to 254	Used to set individual address of each UAB when communications port is used. NB: changes can only be made via the keypad (Chapter 5 refers).
(Lab)	Option 0-75		Label number to print engineering units. (See Chapter 5)
Ln	Log Number	0-19,999	To set Log number. Reset on power up.
Inp	Input Variable		Automatically returns the UAB to the input again after scrolling sequence is completed and updates permanent memory.

RS	Display Resolution	0-255	Sets display resolution 0 & 1 = Resolution of 1 least significant digit. 2-255 = Resolution setting of last digits.

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.
* This number range will increase as new printer options become available.

Table 7.2 Configurable Parameters for Dual Input Modules

Mnemonic	**Descriptions**
InPA	Live display of input 'A'
InPb	Live display of input 'B'
SP1	As for single channel inputs, except when Ab = 4, when SP1 = value set by input 'b'
SP2	As for single channel inputs
PASSWORD	1111
HYS	As for single channel inputs
OL	As for single channel inputs
OA	As for single channel inputs
Pb	As for single channel inputs
Ont or It	As for single channel inputs
OFFt or dt	As for single channel inputs
dA or ct	As for single channel inputs except add 400mS to all display update time
IPLA	Input low scale factor for 'A' input (no IPOF)
IPHA	Input high scale factor for 'A' input (no IPSF)
IPLb	Input low scale factor for 'B' input
IPHb	Input high scale factor for 'B' input
SF	Scale factor, unity being 1.0000 except when AB = 3, then unity = 001.00
DF	Division factor, divides result of function x scale factor, by the value set
OFFS	Offset provides a display offset
OPL	As for single channel inputs
dPB	Sets decimal point position for 'B' input display (for display purposes only)
Cp	For single channel inputs
SdSt/Lab	For single channel inputs
Ln	For single channel inputs
rS	For single channel inputs
dis	Returns to A, B, function display

Ab	***Function***
0	A + B
1	A - B
2	A x B
3	A/B
4	Display = Input A, SP1 = Input B

Display = $\frac{\text{(Result of A, B Function)} \times \text{SF}}{\text{DF}}$

Configurable Parameters for UAFLC - Fast Strain Gauge Input Module

Note: Password Protection

To prevent unauthorised changes to parameters, other than Set Points and In-Flight compensation settings, a 4 digit password number must be entered. Scrolling through the Set Points and In Flight settings until ‘PASS’ is displayed accesses the number. At this point, it is necessary to enter either the factory set number 1111 in D2 - D5 positions, or the password number specifically ordered by the customer.

Table 7.3 Configurable Parameters

CODE	VALUE	FUNCTION
Inp	±19999	Live input reading
P	±19999	Peak reading
t	±19999	Trough (valley) reading

Section 2 - Setting the Conditions for Linear Inputs

To monitor the analogue input, the unit must be programmed for the appropriate input module and select the required resolution.

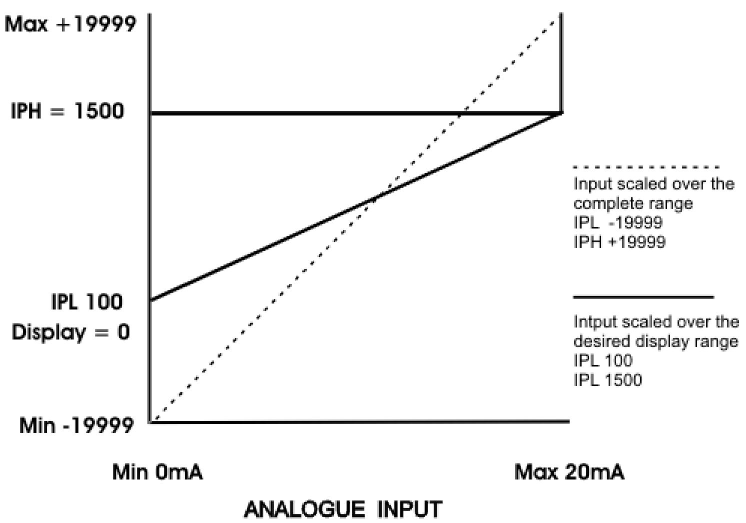
Linear Input Code Selection

The two input code (IP) options offer scaling of the input for:
IP = 0. Scaling between -19999 to +19999
IP = 1. Scaling divide by 10, -1999 to +1999

Linear Input Scaling

Input scaling factors are set by the user and determine the display range over which the analogue module operates. (IPL) Input Low - This sets the displayed value at the modules minimum input. (IPH) Input High - This sets the displayed value at maximum input. If the calculated display is outside the range defined by IPL and IPH, the analogue input will be over-ranged.
Example: Assume a 4-20mA input module is required to provide an input of 4mA at 100 and 20mA at 1500.
Set IPL at 100 and IPH at 1500
It will be necessary to determine IPL and IPH by graphical or mathematical means if the known display values do not coincide with the minimum and/or maximum analogue input.

Figure 7.1 Linear Input Scaling



Method of Calculating IPL and IPH from any known input values

IPL= Low Display $-\dfrac{\text{(Display span) (Low input - Min input)}}{\text{(High input - Low input)}}$

IPH= High Display $+\dfrac{\text{(Display Span) (Max input - High input)}}{\text{(High input - Low input)}}$

High input = Known high input value
Low input = Known low input value
Min input = Lowest measurable value of input PCB fitted
Max input = Highest measurable value of input PCB fitted
Display span = Highest required display value -minus lowest required display value.
Example:
Using a 4.20mA input PCB requiring a display of 200 at 6mA and 8000 at 12mA

	Min	Known Low	Known High	Max
Display Value	IPL	200	8000	IPH
Input Value	0mA	6mA	12mA	20mA

$$IPL = 200 \quad \underline{-((7800)\ (6 - 4))} \over (12 - 6) \quad = 200 - \frac{\underline{7800 \times 2}}{(6)}$$

IPL= 200 - 2600
<u>IPL = -2400</u>

$$IPH = 8000 \quad + \frac{\underline{(7800)\ (20 - 12)}}{(12 - 6)} \quad = 8000 + \frac{\underline{(7800 \times 8)}}{(6)}$$

IPH = 8000 + 10400
<u>IPH = 18400</u>

Note 1: If IPL or IPH are greater than ±19999 then divide both IPL and IPLH by 10, this will give less resolution.
Note 2: Decimal point can be placed anywhere to suit reading.

Input Calibration Routine

Note: It is of the utmost importance that this routine is followed carefully when setting up the instrument with Analogue Inputs.

Most analogue inputs have predetermined calibration constants, which have been written into the software at the time of manufacture; the details of these calibration values are written on a pre-printed white label on each input board against ADCL and ADCH.
The values shown on the labels are to be entered in the following manner: -

Scroll to the PASSWORD mnemonic and enter the number - 2000. Press the scroll key, the display will then show the mnemonic 'ADCL' (A to D Calibration Low value), this prompts the entry of the value written on the label. Once this value has been entered, scroll to the mnemonic 'ADCH' (A to D Calibration High value), which again prompts the entry of the value written on the label.

Note: It is important that the ▲ key is used during this procedure; otherwise the software will attempt to calculate new values for ADCL and ADCH.

Section 3 - The Temperature Input Modules (UAT1 & UAT2)

The UAB provides very accurate temperature measurement from thermocouple or resistance thermometer inputs. The microprocessor line arises the input signal with accuracy ensured by the application of a polynomial expression. This arrangement provides a high-resolution digital readout in units of Centigrade, Fahrenheit or Kelvin, as required. Resolution of either 0.1 or 1.0 degrees can be selected from the keypad.
The input type must be selected on ordering as detailed in the ordering codes shown above (also see Chapter 8).

Setting Up Codes for Thermocouples
To monitor temperature inputs from a thermocouple, set the (IP) code to select the precalibrated analogue input module, together with the required display value and resolution (See Table 7.2).

Thermocouple Cold Junction Compensation

The UATx modules are supplied with a cold junction sensor. For maximum accuracy the cold junction sensor should be placed as close as possible to the junction of copper or non-thermocouple connector cables. This sensor requires to be matched to the UATx otherwise a maximum offset error or ± 2.5% at room temperature may be incurred. To calibrate this offset follow the procedure below: -

1. Short the thermocouple input connection 1 & 2
2. Connect the cold junction sensor across connections 3 & 4
3. Ensure that IPL is at zero
4. Using a reference thermometer, placed so that it is measuring the cold junction sensor temperature, allow the sensor & thermometer to reach thermal equilibrium. Note this temperature.
5. Note the temperature that the UAB display is reading, the difference between the two noted values should be entered into IPL.
6. After entering this value the reading of the reference thermometer & UAB should be similar.

Any further changes to IPL for introducing a system offset to compensate for minor temperature discrepancies between cold junction and the thermocouple cable for example should be added to the value.

Should a display be required in degrees Kelvin, it will be necessary to select the (IP) on 0ºC and set the (IPL) to +273ºC.

Table 7.4 - Thermocouple Input Codes

Thermocouple Type	Range	Readout	Resolution	Code Module	Inputs
J	-170ºC to	Centigrade	0.1	30	
	+760ºC		1.0	31	
			0.1	46	UAT2
		Fahrenheit	1.0	47	
K	-230ºC to	Centigrade	0.1	32	
	+1300ºC		1.0	33	UAT1
			0.1	48	
		Fahrenheit	1.0	49	

Resistance Thermometers

This is normally a PT100 type of RTD.

Resistance thermometer connections to the UAB depend upon the lead configuration, which is itself determined by the required level of accuracy.

For applications where a high accuracy measurement is not required a 2 or 3 wire installation is adequate. For high accuracy, a 4-wire connection should be used to compensate for lead resistance and connector losses.

Setting up Codes for Resistance Thermometers

To monitor temperature inputs from an RTD, set the IP code to select the pre calibrated analogue input module, together with the required display value and resolution as summarised below.

Table 7.5

Display Units	Resolution	Code
Centigrade	0.1	60
Centigrade	1.0	61
Fahrenheit	0.1	58
Fahrenheit	1.0	59

IPL must be set to zero for any of these display options, however, if any offset factor is required e.g. to compensate for minor temperature discrepancies between cold junction and thermocouple cable, set the (IPL) to the required offset value.

Should a display be required in degrees Kelvin, it will be necessary to select the (IP) on 0ºC and set the (IPL) to+273ºC.

Section 4 - The Rate/Totaliser Input Module (UARTL)

General Description

The module allows the monitoring of frequency, RPM, period or pulse totalising from a wide range of transducers, the details of which are shown in Table 7.5

The module can be configured for any of the functions referred to in Table 7.5 and transducer types, by DIL switches keypad set parameters and connections. See Table 7.6

Setting up the Input

The types of input chosen will depend upon the sensor requirements and can be determined from the table below:

Table 7.6

Type	High Pulse Level	Threshold	Hysteresis	Input Impedance	Excitation
DCV	5-30V	2.5V	1.0V	100K min or 5K6	5V, 50mA
ACV1	±30mV to 35V	*20mV-2V	*5mV to 180mV	5K min	5V, 50mA
ACV2	±3V to 35V	*2.5V-35V	*120mV- 2.0V	5K min	5V, 50mA
AC/DCmV	±15mV - 5V	8mV	2mV	10M	5V, 50mA
NAMUR	2.5 to 17mA	1.6mA	90µA	680R	8.3V, 50mA

*Adjustable by potentiometer.

When selecting the type of input required by the sensor, from Table 7.3, set the DIL switches on SW1, as shown in Table 7.4 (The RTL layout diagram Chapter 4 Figure 4.4 refers).

Table 7.7 Input Configuration

Type	SW1) Switch Settings	Legend
	* * **1 2 3 4 5 6 7 8**	
ACV1	1 0 1 0 1 x 0 1	1 - Switch 'on'
ACV2	1 1 0 0 1 x 0 1	
AC/DC mV	0 0 1 0 1 x 0 1	
NAMUR	1 1 0 0 1 x 0 1	0 - Switch 'off'
DCV (pull up for volt free or contact type inputs)	1 0 0 1 0 x 0 1	
DCV (pull down for voltage fed inputs up to 30V)	1 0 0 0 1 x 0 1	x - See Note 1
DCV (Standard CMOS type input)	1 0 0 0 0 x 0 1	
		* - See Note 2

Note 1: Switch 6 selects a low pass filter with a 10uS time constant on DCV Input only

Note 2: For totalising, set switch 7 'on' and 8 'off' on all ranges

Setting the Prescaler

Depending upon the rate of the frequency, RPM or period to be measured or the maximum desired count of the totaliser, it will be necessary to select the prescaler by setting the DIL switches on SW2 as shown in the Table 7.7 below. (See the UARTL layout Figure 4.4)

Table 7.8

Prescaler	(SW2) Switch Settings
	1 2 3 4 5 6
Divide x 1	x 1 0 0 0 0
Divide x 10	x 0 1 0 0 0
Divide x 100	x 0 0 1 0 0
Divide x 1,000	x 0 0 0 1 0
Divide x 10,000	x 0 0 0 0 1

Legend
1 - Switch 'on'
0 - Switch 'off'
x - Not used

Note 1: Select only one switch to the 'on' position
Note 2: It will be necessary to increase the prescale divide factor by setting the switch to a higher position if the input is over range.

Rate Measurement

Rate measurements are achieved by measuring the period between input signals.
From this, period measurements, frequency and RPM can be derived.
These measurements can be scaled to any desired display range by setting scale and offset factors from the keypad together with a prescaler set from DIL switches on the module.
SW1 7 off, 8 on, and IP set by keypad to Table 7.8

Period (Time measurement between pulses)

Period measurements from 20µS to 1999.9mS can be monitored by means of prescaler and is divided into 2 ranges:

Input Code

The input code (IP) sets the type of rate measurement required i.e. Period, Frequency, and RPM and is selected from the table below: -

Table 7.9

Type	Code	Divide by 10
Frequency	12	13
RPM High Resolution	14	15
RPM	16	17
Period in mS	2	3
Period in µS	6	7

(i) Period in mSeconds

Table 7.10 Period mS Fixed Scale

Prescale	Divide by 1	Divide by 10	Divide by 100	Divide by 1000	Divide by 10000
Input	0.2mS to 1999.9mS	0.02mS to199.99mS	0.02mS to19.999mS	20µS to1999.9µS 0.1µS	20µS to 199.99µS
Resolution	0.1mS	0.01mS	0.001mS	0.1µS	0.01µS
Noise	0.1mS	0.01mS	0.001mS		0.01µS

(ii) Period in µSeconds

Table 7.11 Period µS Unity Scale (IPSF 1.0000)

Prescale	Divide by 1	Divide by 10	Divide by 100
Input	150µS to 19999µS	20µS to 999.9µS	20µS to 199.99µS
Resolution	1.0µS	0.1µS	0.01µS
Noise	3.0µS	0.3µS	0.03µS

NB: These tables only apply when the scale factor is set to unity and the offset is zero.

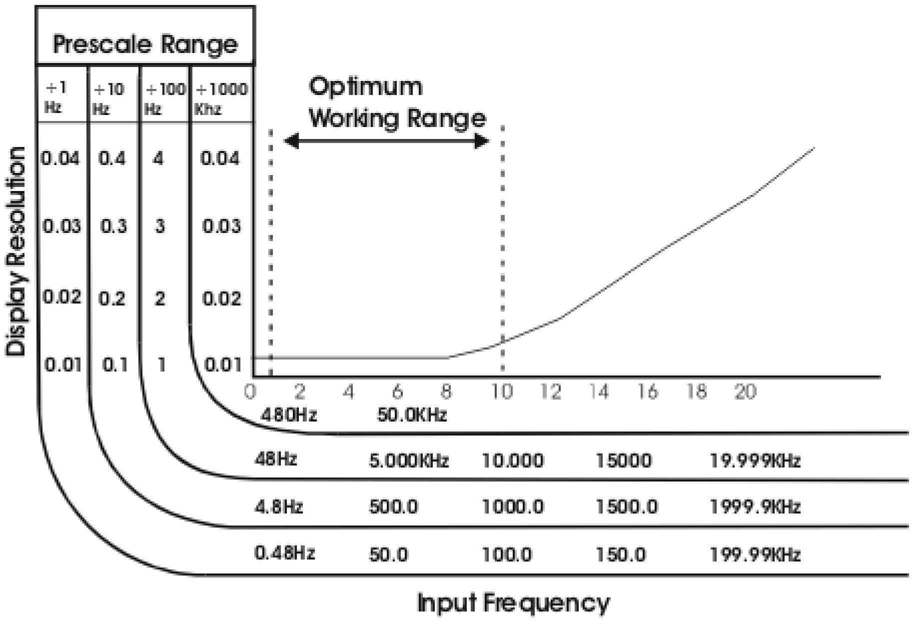
Frequency

Frequency measurements from 0.48Hz to 50KHz can be monitored be means of prescaler.

Table 7.12

Prescale Range	Divide by 1	Divide by 10	Divide by 100	Divide by 1000
Full input Range	0.48Hz to199.99Hz	4.8Hz to1999.9Hz	48Hz to19.999KHz	480Hz 50KHz
Optimum Input Range	0.48Hz to100.00Hz	4.8Hz to 1KHz	48Hz to 10KHz	480Hz 50KHz

Figure 7.2 Frequency Unity Scale Inputs



Worst noise level = 3 x resolution for the same input frequency

Note: This applies when the scale factor is set to unity and the offset is zero.

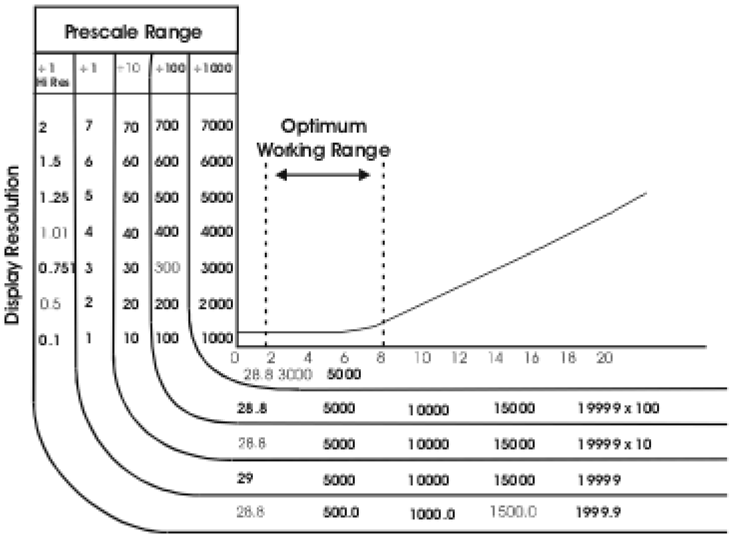
RPM

RPM measurements from 28.8 to 3 million can be monitored be means of prescaler and high-resolution range and represented by 1 pulse per revolution.

Table 7.13 RPM Unity Scale

Prescale Range	Divide by 1 High (0.1) Resolution	Divide by 1	Divide by 10	Divide by 100	Divide by 1000
Full Input Range	28.8 to 1999.9	29 to 19999	28.8 to 19999 x 10	28.8 100 19999 x100	28.8 x 1000 3000 x 1000
Optimum	28.8 to 500	29 to 7000	28.8 x 10 to 700 x 10	28.8 x100 to 7000 x100	28.8 x 1000 3000 x 1000

Figure 7.3 RPM Unity Scale Range



Worst Noise Level = 3 x resolution for the same input
Input RPM

Count/Rate Scaling & Scaling/Rate

The count/rate input can be represented over any display range by applying keypad set parameters known as scale and offset factors.
The actual count/rate would be displayed when the scale factor is unity (1.0000) and offset factor is zero.
The scale factor applies a variable gain to the count/rate and is set by the mnemonic (IPSF)

IPSF is calculated as follows:

IPSF = **<u>Required change in display digits</u>**
Change in count/rate value

IPSF has a range of 0.0001 to 1.9999

The offset factor is added to or subtracted from zero offset displayed value and is set by the mnemonic (IPOF).

IPOF is calculated as follows:

IPOF = required display digits - (IPSF x required count/rate value)

IPOF has a range from -12767 to +19999

Scaling Example: -

For a low frequency input of 139Hz, a display of 46 litres per minute is required for a high frequency input of 710Hz; a display of 250 litres per minute is required.

Scale Factor - IPSF = $\frac{250 - 46}{710 - 139} = \frac{204}{571} = 0.3573$

Therefore <u>IPSF = 0.3573</u>

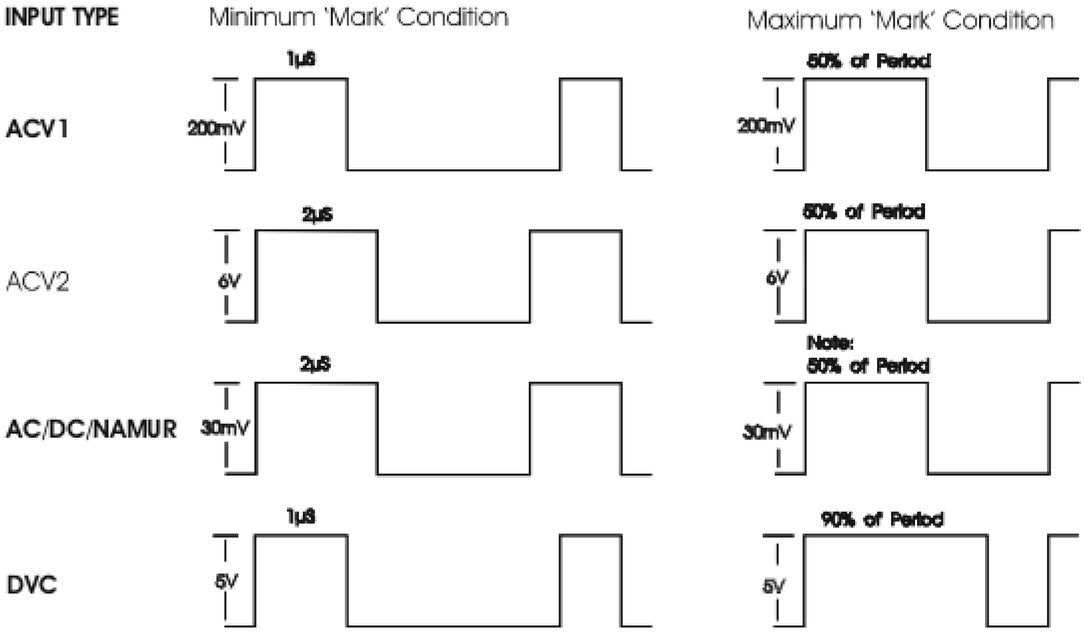
Offset Factor - IPOF = 250 - (0.3573 x 710) = -3.683

Therefore <u>IPOF = - 3.683</u>

RTL Module Inputs

Figure 7.4 RTL Module Inputs

The RTL module can accept four types of input as follows: -



Notes: Minimum period equals 20µS

: For ACV2 inputs over 6V with greater than 50% 'Mark' use ACV1.

Section 5 - Programming the Output Functions

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 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 energised 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-energised 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.

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.

Latching Outputs (OL)

The latching facility allows the relay module output to be held until reset either by keypad, external remote or via the communications port.
Latching is applied to the off status of the relay SP1 or SP2.

Table 7.14 Output Latch Codes (OL)

SP1	SP2	Code
Unlatched	Unlatched	0
Latched	Unlatched	1
Unlatched	Latched	2
Latched	Latched	3

Display OL and enter required code using the keypad as detailed in Chapter 3.

Output Action (OA)

The output action facility allows the user to determine whether set points produce normal or inverted output operation. If an analogue output module is also fitted, the output action function determine whether the modules output is inverted or not and if PID power level is also directed to the analogue output. The output action (OA) is entered by a code to suit the requirements of the user.

Output Action options are available.
The value of the OA to be entered in the algebraic sum of the following components:

Table 7.15 Output Action Codes (OA)

SP1 Inverted	= 1
SP2 Inverted	= 2
PID on Analogue Output	= 4
AN-OP Inverted	= 8

Example 1: If SP1 requires to be inverted and PID on the analogue output, enter 4 + 1 = 5.
Example 2: To invert the analogue output and invert SP2, enter 8 + 2 = 10

Delay Timers

For applications where PID is not used (PB=0) and time delayed outputs are specified, 'ON' and delay 'OFF' times can be set via the keypad.

Delay On Timer

The delay on timer applies to SP1 and SP2 and initiates a delay before either set point can turn on. The delay timer will be reset if the off state is called for during the delay time. This is set by ‘ont’ code in seconds ranging from 0 to 255.

Delay Off Timer

The delay off timer applies to SP1 and SP2 and initiates a delay before either set point can turn off. The delay timer will be reset is the on state is called for during the delay time. This is set by ‘oFFt’ code in seconds ranging from 0 to 255.

PID Functions

The four components of a PID function are proportional band (Pb), integral time (It) and derivative time (dt). The cycle time is set by input code (ct).
To set the proportional band, display (Pb) and enter the required operating band in terms of the displayed units as described in Chapter 3.

When PB is selected, the Relay 1 (SP1) is used by the PID as a time proportional output.

PID Empirical Tuning

1. Set Pb to the max 1023 and ct to a low value consistent with the mechanical constraints and system requirements.

2. Vary the input or the set point and note the system response, reduce the Pb by half and repeat, continue to reduce Pb until the process starts to oscillate, then increase Pb until it is stable.

3. Set the integral time to max (6000) and reduce it in stages until the proportional offset is eliminated. There should be a slow oscillation around set point.

4. Set a low value of dt and gradually increase this until the slow oscillation ceases.

5. Lower the value of Pb and increase the value of dt after each change, disturb the process and check that control is maintained. The final setting will be that which gives satisfactory control in the presence of these small disturbances.

6. The following equation must be applied to ensure that the system operates correctly

$$\frac{ct}{Pb \times it}$$

must be greater than the constant .00012255 where Pb is expressed in whole numbers, ignoring any decimal point setting.
i.e. 100.0 will be taken as 1000

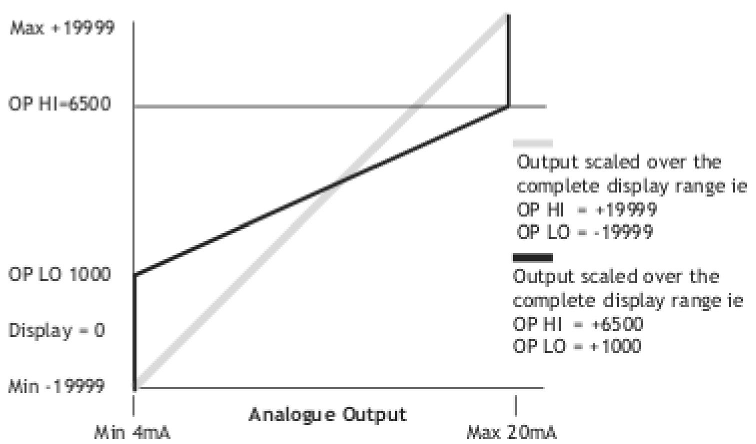
Section 6 - Scaling the Analogue Outputs

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.

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 7.5 Analogue Output



Method of Calculating OPL & OPH from any known Output & Display Values

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

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

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.

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

OPL = 400 - 116.66
<u>OPL = 283.34</u>

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

OPH =1100 +116.66

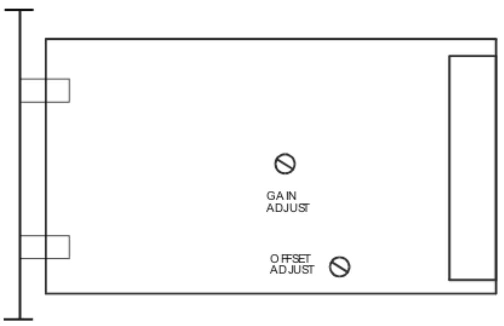
<u>OPH =1216.66</u>

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.
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 OP LO and OP Hi.
An offset can be achieved by increasing the values of both OP LO and OP Hi, and the gain by increasing the range between OP LO and OP Hi.

Figure 7.6 Showing the Potentiometers for Gain and Offset Adjustment



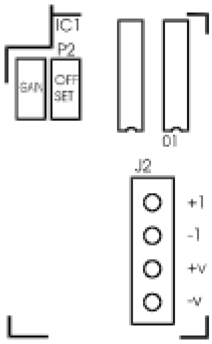
As described in Chapter 5 the Fast Analogue Output module is specifically designed to be used when the fast strain gauge input module, (UAFLC) is fitted. **(However due to physical constraints the module can be used with the Universal Amplifier in its surface mount configuration only.)** Although output scaling follows a similar procedure to that of the standard analogue outputs, the re calibration adjustments required to the fast analogue output module are shown in the following diagram:

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 7.7 Showing the Potentiometers for Gain & Offset Adjustment



Chapter 8 Order Codes

RUA Rack Mounted Universal Input Process Amplifier

Inputs

0 to 10Volts		UADCV1
0-20mA DC Volts		UADCA1
LDVT Input		UALV1
Temperature Input	Type K	UAT1
	Type J	UAT2
	PT100	UAPT
	Rate/Totaliser	UARTL
Dual Channel LVDT Input		UALV2
Dual Channel 4 to 20mA Input		UADIA
Dual Channel 0 to 10V Input		UADIV
Fast Strain Gauge		UAFLC

Comms/Printer Port

Communications	20mA Current Loop	RC1
	RS232/485	RC3

Relay Module

Relay Output Module (2 x SPCO 500mA50V)	RR1

Amplifier/Display

Universal Amplifier for Remote Programmer (LP2)	RUA1
Universal Amplifier with internal Programmer	RUA2
Universal Amplifier for Remote Programmer (LP3)	RUA1-EX

Accessories

Rack PSU for RF1 & RF2	RS1
Rack for 12 Channels with Remote Programmer	RF1
Rack for 8 Channels with Internal Programmer	RF2
Blanking Panels for RF1	RB1
Blanking Panels for RF2	RB2
Remote Programmer for Standard & Fast Input Module	LP2
Programmer for Hi Res Input Modules	LP3
VisualLink SCADA Software Full Version	VLA
VisualLink Runtime Key	VLR
VisualLink SCADA Software Demo	VDL

UAB Universal Amplifier

Description	Order Code
Universal Amplifier with 4-20mA/0-10V Analogue for either ABS Case or DIN Rail Mounting	UAB

Inputs

0 to 10Volts		UADCV1
0-20mA DC Volts		UADCA1
LDVT Input		UALV1
Temperature Input	Type K	UAT1
	Type J	UAT2
	PT100	UAPT
	Rate/Totaliser	UARTL
Fast Strain Gauge		UAFLC

Comms/Printer Port

Communications	20mA Current Loop	LC1
	RS232/485	LC3

Relay Module

Relay Output Module (2 x SPCO 500mA50V)	LR1

Power Supplies AC & DC

AC Power Supply 110/120V or 220/240V AC	LS1
DC Power Supply 9-32V DC	LS3

Amplifier/Display

Display PCB for fitting to LAC ABS Case	LP1

Mounting & Cases

ABS Case with plain ABS Lid	LAB
Stainless Steel Case 220 x 160 x 85mm	LSS
Die Case 220 x 160 x 85mm	LDC
DIN Rail Mounting fixture for the LCB/UAB	D2
Transparent Plastic Case Lid for ABS Case	LTL

Accessories

Conformal Coating of PCBs	LCC
Remote Hand Held Programmer	LP2
Programmer for Hi Res Input Modules	LP3
VisualLink SCADA Software Full Version	VLA
VisualLink Runtime Key	VLR
VisualLink SCADA Software Demo	VDL

SMP Surface Mount Process Indicator & Controller

Inputs

0 to 10Volts		UADCV1
0-20mA DC Volts		UADCA1
LDVT Input		UALV1
Temperature Input	Type K	UAT1
	Type J	UAT2
	PT100	UAPT
	Rate/Totaliser	UARTL
Dual Channel LVDT Input		UALV2
Dual Channel 4 to 20mA Input		UADIA
Dual Channel 0 to 10V Input		UADIV
Fast Strain Gauge		UAFLC

Comms/Printer Port

Communications	20mA Current Loop	LC1
	RS232/485	LC3

Relay Module

Relay Output Module (2 x SPCO 500mA50V)	LR1

Power Supplies AC & DC

AC Power Supply 110/120V or 220/240V AC	LS1
DC Power Supply 9-32V DC	LS3

Amplifier/Display

Display PCB for fitting to LAC, ABS Case	LCD
As above (LCD) with backlight	LCD/BL
Display PCB fitted with a driver for extended distance working - 100 metres ABS Case	LCDR
As (LCDR) with backlight	LCDR/BL

Mounting & Cases

ABS Case prepared for PCB with front label (no PCB fitted)	LAC
DIN Rail Mounting fixture for the LCB/UAB	D2
Stainless Steel mounting for display PCB	LCS

Accessories

Conformal Coating of PCBs	LCC
VisualLink SCADA Software Full Version	VLA
VisualLink Runtime Key	VLR
VisualLink SCADA Software Demo	VDL

CE Approvals

European EMC Directive	2004/108/EC
BS EN 61326-1:2006
BS EN 61326-2-3:2006

Low Voltage Directive	2006/95/EC
BS EN 61010-1:2001
Rated for Basic Insulation
Normal Condition
Pollution Degree 2
Permanently Connected
Insulation Category III

Instrument Setup Record Sheet

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

UAB/RUA/SMP	**Value**
PASS	
SP1	
SP2	
HYS	
OL	
OA	
Pb	
Ont (It)	
OFFt (dt)	
dA (Ct)	
IPL (IPOF)	
IPH (IPSF)	
OPL	
OPH	
IP	
dP r	
CP	
SdSt or LAb	
Ln (for printer)	
rS	

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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.

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ISO 9001 REGISTERED FIRM

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