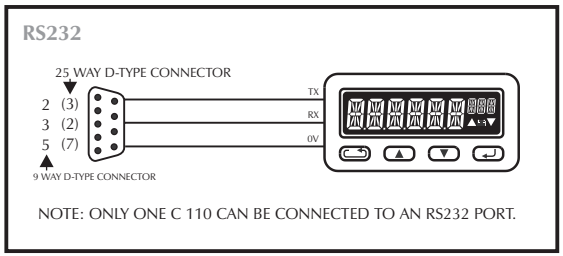
COMMUNICATIONS

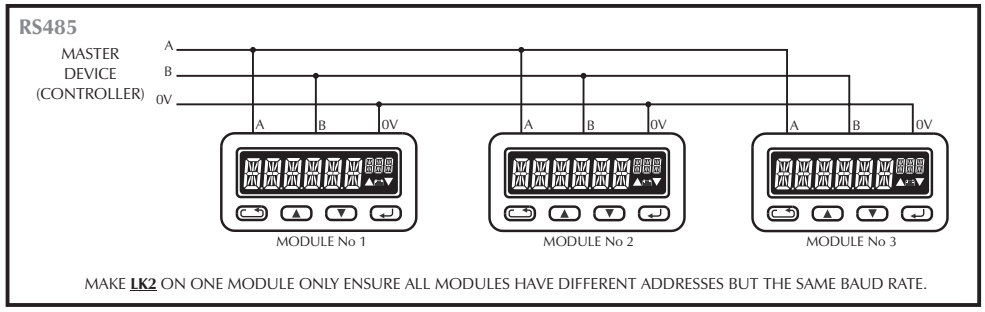
RS232

The RS232 port can be used to communicate with one module at a time. No more than one module must be connected to an RS232 port at any one time. To connect the C 110 to a host RS232 port, follow the diagram below.



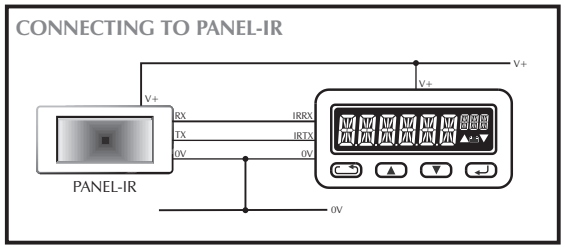
RS485

Multiple modules may be connected to the RS485 port at any one time. The RS485 port can be used to communicate with one module at a time. Ensure that all C 110 modules have different addresses but the same Baud rate. To connect the C 110 to a host RS485 port, follow the diagram below.



INFRARED

To add InfraRed communications capability to C 110, connect it to a PANEL-IR module. The InfraRed port can be used to communicate with one module at a time. Multiple modules may be connected to the InfraRed port at any one time. To connect the C 110 to a Lascar PANEL-IR, follow the diagram below



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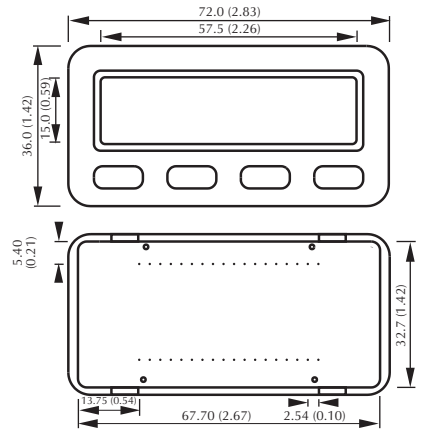
C 110 is the second module in a family of programmable LCD counter modules. This microcontroller-based module is designed round a 6+3 character alphanumeric starburst LCD. The LED backlit display shows the 6 digit counter readings as well as a comprehensive operator menu. Navigation through the menu, using the front keypad, is straightforward. Besides displaying the measured frequency, the module can be made to control external events via its two open collector outputs.
C 110 can communicate with other intelligent systems via its built-in RS232 and RS485 communication ports. This module is compatible with Lascar's InfraRed communications products, such as PANEL-IR. To make assembly easy, the meter is housed in a snap-in DIN-sized enclosure.

- 6 Digit Frequency Counting
- Password Protection
- Choice of Annunciators
- Leading Zero Blanking
- Modules can be Networked
- Remembers Settings

Standard Meter			Stock Number C 110	
Specification	Min.	Typ.	Max.	Unit
Supply voltage	4.5	5	5.5	V d.c.
Supply current (Backlighting on)		40		mA
Supply current (Backlighting off)		25		mA
Input voltage (Count input)	1		15	V d.c.
Input impedance (Fin = 0Hz)		10		kΩ
Input frequency	1		999999	Hz
Resolution		1		Hz
Minimum input pulse width	0.5			µs
Accuracy (overall error)		20		ppm
Sample Rate		1		Sample/Sec
Operating temperature range	0		50	°C
Input transition rise or fall time			30	ms

DIMENSIONS All dimensions in mm (inches)



Panel cut-out
68 x 33 (2.68 x 1.30)

PANEL FITTING

Locate the meter by passing it through the front panel cut-out, gently pushing until the rear of the bezel is flush with the panel.
The snap-in lugs will now automatically hold the meter firmly in position.

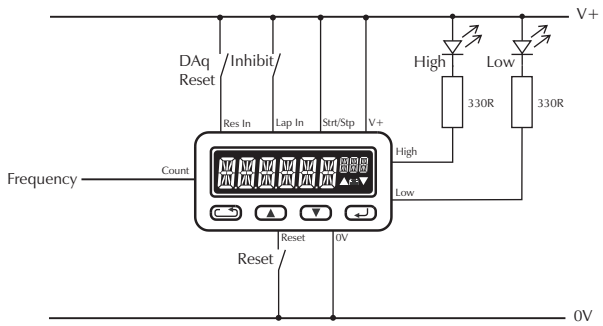
WEBSITE: http://www.lascarelectronics.com/

PIN FUNCTIONS

V+	Positive supply voltage.
0V	Negative supply voltage.
COUNT IN	Frequency measurement input.
0V	Ground for the count input.
LAP IN	When taken High, the displayed reading is held indefinitely. The internal frequency counter continues to operate. When left floating or taken Low, the display is normally updated.
STRT/STP	Connect to V+ for normal operation.
RES IN	Take High to reset the data acquisition section when software filtering is used.
UP-DN	Not connected.
HIGH	High Alarm output. Open collector output, capable of sinking up to 50mA. Goes Low when the reading is equal to or larger than the preset Hi Alarm value. (Alarms must be enabled)
LOW	Low Alarm output. Open collector output, capable of sinking up to 50mA. Goes Low when the reading is equal to or larger than the preset Lo Alarm value. (Alarms must be enabled)
232 TX	RS232 communications port (transmit line).
232 RX	RS232 communications port (receive line).
0V	Ground for the RS232 and RS485 communications ports.
485A	RS485 communications port.
485B	RS485 communications port.
RESET	Take Low to reset the module.*
IR RXD	InfraRed Receive connection.
IR TXD	InfraRed Transmit connection.
0V	Ground for InfraRed communications section.
NC5	Not connected.
NC4	Not connected.
NC3	Not connected.
NC2	Not connected.
NC1	Not connected.
ZERO	Not connected.
=	Not connected.
C/O	Not connected.
NC0	Not connected.
SW4	External switch input. Take Low to mimic the front panel ESC button.
SW3	External switch input. Take Low to mimic the front panel UP button.
SW2	External switch input. Take Low to mimic the front panel DOWN button.
SW1	External switch input. Take Low to mimic the front panel ENTER button.

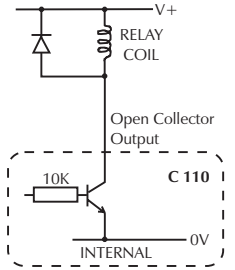
Low = 0V
High = +5V
* When reset is taken Low, all the module's settings are reset to the last ***saved*** settings, otherwise the default values are used.

APPLICATIONS



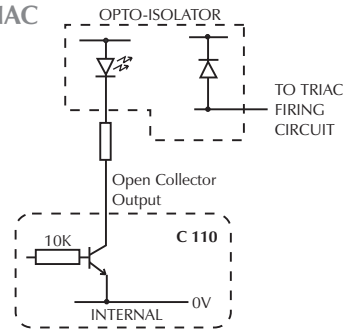
Evaluation Circuit showing use of C110 inputs and outputs.

RELAY



Using an Open Collector Output to drive a relay.

TRIAC

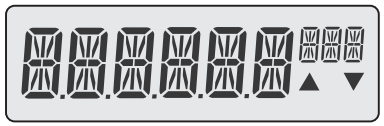


Using an Open Collector Output to drive a Triac.

IMPORTANT SAFETY INFORMATION

To comply with the Low Voltage Directive (LVD 93/68/EEC), input voltages to the module's pins must not exceed 60Vdc. If voltages to the measuring inputs do exceed 60Vdc, then fit scaling resistors externally to the module. The user must ensure that the incorporation of the C 110 into the user's equipment conforms to the relevant sections of BS EN 61010 (Safety Requirements for Electrical Equipment for Measuring, Control and Laboratory Use).

DISPLAY INDICATORS



6 Large Starburst Digits

- In Normal Mode, the 6 Large Starburst Digits are used to display the measured input value.
  In Menu Mode, the 6 Large Starburst Digits are used to display the menu options.

3 Small Starburst Digits

- In Normal Mode, the 3 Small Starburst Digits are used to display the chosen engineering symbol (Annunciator).
  In Menu Mode, the 3 Small Starburst Digits are used to display some of the menu options.

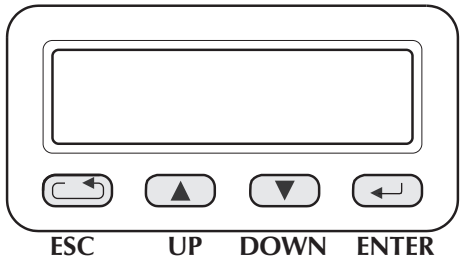
Up Arrow

- In Normal Mode, the Up Arrow indicates that the displayed reading has exceeded the High Alarm level.
  In Menu Mode, the Up Arrow indicates that one or more menu options are available by pressing the Up Arrow button.

Down Arrow

- In Normal Mode, the Down Arrow indicates that the displayed reading has exceeded the Low Alarm level.
  In Menu Mode, the Down Arrow indicates that one or more menu options are available by pressing the Down Arrow button.

FRONT KEYPAD FUNCTIONS



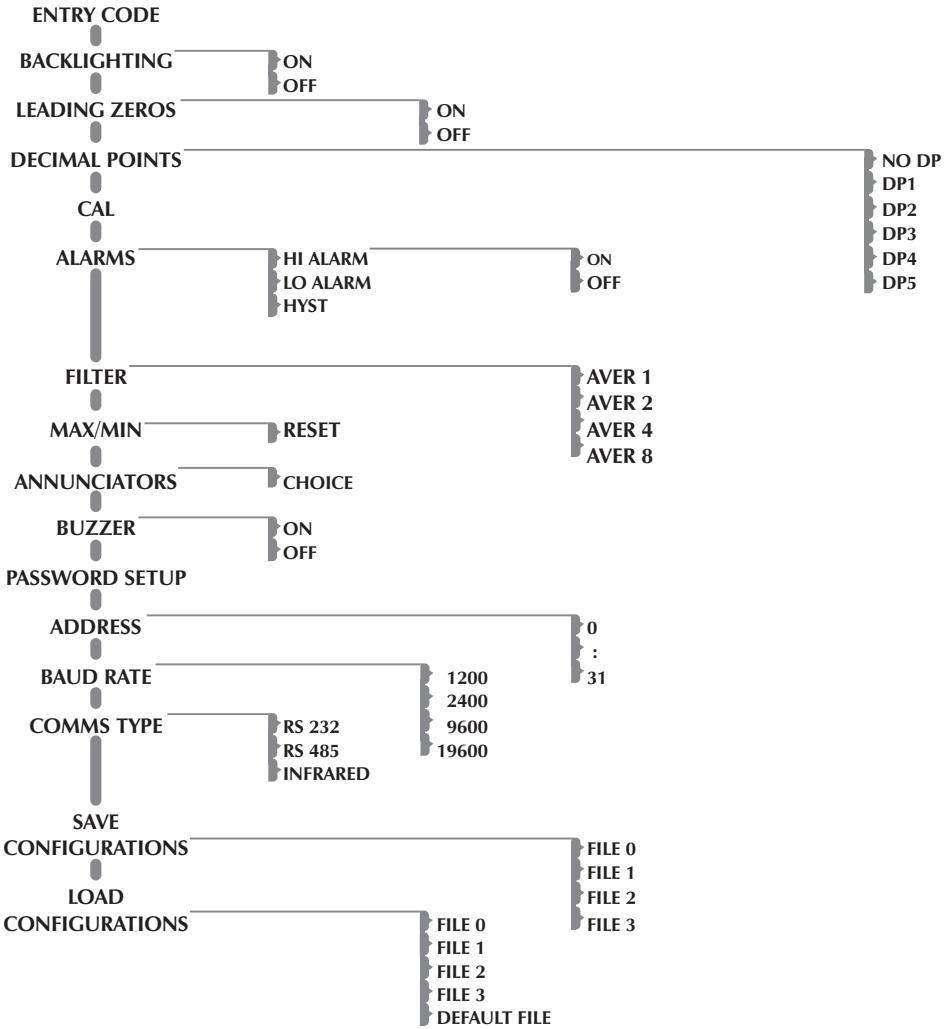
In NORMAL MODE

ESC	:	Toggles LED backlighting on and off and exits from MAX and MIN readings.
UP	:	Displays highest encountered reading since power-up (MAX).
DOWN	:	Displays lowest encountered reading since power-up (MIN), normally 000000.
ENTER	:	Enters operator menu at password level.

In MENU MODE

ESC	:	Escapes the operator to the previous menu level or progresses to the next digit when entering values.
UP	:	Scrolls upwards through the available options until the end of the options list has been reached. Only available if the Up Arrow is shown on the LCD.
DOWN	:	Scrolls downwards through the available options until the end of the options list has been reached. Only available if the Down Arrow is shown on the LCD.
ENTER	:	Toggles between available options or selects current option, depending on location in menu.

THE MENU MAP



The module will remember the current configuration settings for as long as the module receives a correct supply voltage. When power is removed (or reduced below the "correct" supply voltage) and re-applied, all settings are lost, and the module powers up to the last saved settings. If none were saved, the module powers up to the factory default settings. To avoid losing your settings, save them in one of four "File" locations. See Saving on page SW5 for details on how to save configuration settings.

SERIAL PROTOCOL

Additional Command Details

"ALL"
Sends data about the setup of the meter to the master unit. The following data is sent.

FIRMWARE VERSION
ALARM ON/OFF
HIGH ALARM VALUE
LOW ALARM VALUE
HYST VALUE
MATHS m VALUE
MATHS c VALUE
AVERAGING (1=Normal, 2=2 Readings, 3=4 Readings, 4=8 Readings)
LEADING ZEROS ON/OFF
DP SELECTION
ANNUNCIATORS
BACKLIGHT ON/OFF
BUZZER ON/OFF

Notes:
Do not try to link up more than one module to a RS232 serial bus as it is only designed for two devices (transmitter & receiver).

RS232 and RS485 communications require 8 Data Bits, 1 Stop Bit and No Parity.

All serial communications must be started with an address aa, the default value of which is "00". Two or more modules sharing the same RS485 serial bus cannot have the same address or all will try to reply at once, giving an error condition. If the address of the module is not known, then use **<command>, where ** is used as an 'any meter reply' command. To avoid device conflict when using this command, only one counter should be attached to an RS485 serial bus at any one time.

All commands must be followed by a CRLF (Carriage Return & Line Feed). The serial port has a certain amount of memory allocated which will loop around if too many characters are sent, therefore protecting against bad data.

A response of '1' shows that the module has responded.
A response of '0' usually shows that an illegal value has been input by the user, although a counter was attached at that address.
No response indicates that no meters are connected to that address.

Some changes will not take effect until the next full sample is taken and displayed, e.g.: when Signal Averaging is set to 8, changes will take effect after 8 seconds.

SERIAL PROTOCOL

All commands are case-sensitive and must be preceded by a two digit address *aa*, corresponding to the meter's address. The default address is 00.

DESCRIPTION	ADDRESS	COMMAND	RESPONSE
ALARMS			
ALARMS ON	aa	A1	1
ALARMS OFF	aa	A0	1
SET LOW ALARM VALUE	aa	ALxxxx	1
SET HIGH ALARM VALUE	aa	AHxxxx	1
SET HYSTERESIS VALUE	aa	AYxxxx	1
COMMUNICATIONS			
NEW BAUD RATE (1200BPS)	aa	B0	1
NEW BAUD RATE (2400BPS)	aa	B1	1
NEW BAUD RATE (9600BPS)	aa	B2	1
NEW BAUD RATE (19200BPS)	aa	B3	1
NEW ADDRESS (00 - 31)	aa	Nxx	1
COMMS SELECTION (RS232)	aa	I0	1
COMMS SELECTION (RS485)	aa	I1	1
COMMS SELECTION (INFRARED)	aa	I2	1
(The response will be in the newly selected mode.)			
READ MAX VALUE	aa	M0	MAX VALUE
READ MIN VALUE	aa	M1	MIN VALUE
RESET MAX/MIN VALUES	aa	M2	1
LEADING ZEROS ON	aa	Z1	1
LEADING ZEROS OFF	aa	Z0	1
SET m VALUE (y=mx+c)	aa	Dxxxx	1
SET c VALUE (y=mx+c)	aa	Cxxxx	1
SIGNAL AVERAGING			
UPDATE 1 SAMPLE	aa	K=0	1
UPDATE 2 SAMPLES	aa	K=1	1
UPDATE 4 SAMPLES	aa	K=2	1
UPDATE 8 SAMPLES	aa	K=3	1
DP SELECTION			
ALL DP'S OFF	aa	J0	1
DP1 SELECTION	aa	J1	1
DP2 SELECTION	aa	J2	1
DP3 SELECTION	aa	J3	1
DP4 SELECTION	aa	J4	1
DP5 SELECTION	aa	J5	1
GENERAL			
HELLO ?(Any meters attached?)	aa	R	1
READ MODULE SERIAL NUMBER	aa	F0	SER NO
BACKLIGHTING OFF	aa	G0	1
BACKLIGHTING ON	aa	G1	1
BUZZER ON	aa	Q1	1
BUZZER OFF	aa	Q0	1
CURRENT LCD READING	aa	V	LCD READING
"ALL"	aa	X	INFO (See next page for details.)
SET ANNUNCIATORS	aa	Exxxx	1
LOAD DEFAULT SETUP	aa	UD	1
LOAD SETUP FROM FILE n	aa	Uln (n=03)	1
SAVE EXISTING SETUP TO FILE n	aa	Usn (n=03)	1

THE OPERATOR MENU

The user can configure the C110 via the 4 push buttons on the front of the module. Alternatively, use the SW1 to SW4 pins on the rear.

MENU FUNCTIONS

Press ENTER, then enter the passcode. UP and DOWN change the digit to the required code. ESC progresses to the next digit. Press ENTER on the correct code to gain access to the configuration menu. The default code is 0000.

LCD Backlighting : BACK L

This module features LED Backlighting to illuminate the LCD under low light conditions.

- Default state: ON.
- Pressing ENTER will toggle the backlighting ON/OFF. (when saved, this determines the condition on power up)
  Note: in Normal Mode, ESC toggles the backlighting ON/OFF.

Leading Zero: ZEROS

In applications where Leading Zeros (e.g. 000582) are not required, these can be blanked (e.g. 582).

- Default state: ON (all leading zeros are visible).
- Pressing ENTER will toggle the leading zeros ON/OFF.

Decimal Point Selection: DP

Choose the appropriate Decimal Point for your readout.

- Default state: No Decimal Points are displayed.
- Press ENTER to go to the Decimal Point submenu.
- UP and DOWN scroll through the available options (No DP, DP1 ... 5).
- Pressing ENTER selects the required Decimal Point.

Calibration: CAL

Choose the appropriate Calibration setting for your frequency count input. This is achieved via a two point calibration method. The first point is fixed at 0Hz input = zero on display. The second point is set by presenting a known frequency to the Count input, and entering the desired reading at that frequency.

- Default value: Factory default
- Press ENTER and select DEFault or CUStom calibration.
- If CUStom is selected, then use UP and DOWN to change the digits to the required Calibration value. ESC progresses to the next digit.
- Pressing ENTER accepts the new Calibration value. Pressing ENTER again confirm acceptance. Pressing ESC cancels the calibration operation.

Alarm Levels and Hysteresis: ALARMS

Preset two Alarm trip points with hysteresis. The hysteresis value is the difference in reading between an alarm switching on and switching off. For example: Hysteresis = 100, High Alarm = 10000, Low Alarm = 200
High Alarm switches on at 10000 and off at 9900,
Low Alarm switches on at 200 and off at 300

When a HI Alarm or LO Alarm level is tripped, the corresponding output will go Low, the Up or Down arrow will be displayed on the LCD and the buzzer will sound if it has been enabled in the menu.

- Default state: No Alarm levels set, Hysteresis set to zero.
- Press ENTER to go into the Alarms menu. UP and DOWN scroll through the four programmable alarm options:
  - AL ON/OFF - Pressing ENTER will toggle the Alarms (HI AL and LO AL). The effect on the open collector outputs and buzzer is evaluated on the first reading after exiting the menu.
  - HI AL Set a value for the high alarm level between 0 and 999999.
    - Press ENTER and the display reads any previously set value (Default is 100000).
    - UP and DOWN change the polarity and digit values. ESC progresses to the next digit.
    - Pressing ENTER accepts the HI AL setting. The effect on the HI output and buzzer is evaluated on the first reading after exiting the menu.
  - LO AL Set a value for the low alarm level between 0 and 999999.
    - Press ENTER and the display reads any previously set value (Default is 100000).
    - UP and DOWN change the polarity and digit values. ESC progresses to the next digit.
    - Pressing ENTER accepts the LO AL setting. The effect on the LO output and buzzer is evaluated on the first reading after exiting the menu.

- HYST Set a value for the Hysteresis level between 0 and 999999.
  - Press ENTER and the display reads any previously set value (Default is 000000).
  - UP and DOWN change the polarity and digit values. ESC progresses to the next digit.
  - Pressing ENTER accepts the HYST setting.

Set any unused alarm levels to a value that can in practice never be reached, 999999 (high alarm) or -1 (low alarm).
When an alarm level is tripped, the appropriate output will go low, the up or down arrow will be displayed on the LCD and the buzzer will sound if it has been enabled by the user. Pins HI and LO go Low when their respective alarm levels have been reached.

Note: There are no criteria for the setting of alarm levels. Values may be equal or inverted, hysteresis level may overlap.
When an Alarm level has been reached, the buzzer if switched ON will give an audible warning. The buzzer will stop sounding when the Alarm condition is no longer reached, bearing in mind the amount of hysteresis you have set.
The alarms are evaluated after every display update (see Filter below).

Filter Selection: FILTER

The counter can be preset to average readings. Select the number of readings to average from the list.

AVER = 1 Every sample is shown, no averaging takes place.
AVER = 2 The average of 2 consecutive samples is taken and displayed every 2 seconds.
AVER = 4 The average of 4 consecutive samples is taken and displayed every 4 seconds.
AVER = 8 The average of 8 consecutive samples is taken and displayed every 8 seconds.

- Default value: 1
- Press ENTER to select a new average value. UP and DOWN change the number of samples to average. ESC progresses to the next digit.
- Pressing ENTER accepts the new value.

Maximum and Minimum Readings: MAXMIN

The module can memorise the highest and lowest encountered readings (MAX and MIN) since power-up.

- Note: In Normal Mode, UP displays the highest encountered reading since power-up,
  DOWN displays the lowest encountered reading since power-up.
  This has no effect on the status of the Alarm and Equals outputs and on the buzzer.
- Default state: Module remembers the highest and lowest encountered readings.
- Pressing ENTER in this part of the menu resets the MAX and MIN values to zero.

Annunciator Selection: ANNUN

Select one from a choice of preprogrammed Engineering Units.

- Default state: No annunciators displayed.
- UP and DOWN scroll through the available options (Current Selection, Hz, kHz, MHz, x10, 000, QTY, deg, kWh, m/s, l/m, l/s, None)
- Pressing ENTER selects the required Annunciator.

Audible Feedback: BUZZER

The module features a buzzer which emits a tone when a key is pressed or when an Alarm level has been reached.

- Default state: OFF
- Pressing ENTER toggles the buzzer ON/OFF.

Passcode Protection: CODE

The module incorporates a four digit Passcode facility. This security feature allows a system administrator to ensure that the configurations set up via this menu cannot be changed, either by accident or malice.

- Default value: 0000
- Press ENTER to select a new Passcode. The display reads 0000. UP and DOWN change the digits to the required code. ESC progresses to the next digit.
- Pressing ENTER accepts the new Passcode.

DO NOT FORGET YOUR PASSCODE AS WITHOUT IT, YOU CANNOT ENTER THE MENU SYSTEM.

Module Address: ADDR

Each module in a networked system can be assigned its own unique address, ranging from 0 to 31 inclusive.

- Default address: 00
- Press ENTER to activate Address selection. UP and DOWN select the required module Address.
- Pressing ENTER accepts the new Address.

Note: To avoid communication conflicts in a networked system, no two modules must share the same address.

Baud Rate: BAUD

Select an appropriate Baud rate to communicate with the module over an RS232, RS485 or InfraRed link.

- Default value: 9600
- Press ENTER to activate Baud rate selection. UP and DOWN select the required Baud rate from 1200, 2400, 9600 and 19200 Baud.
- Pressing ENTER accepts the new Baud Rate.

Communications: COMMS

Select an appropriate communications link.

- Default state: RS232
- Press ENTER to activate Comms selection. UP and DOWN select between RS232 (232), RS485 (485) and InfraRed (IR).
- Pressing ENTER accepts the new Communications Link.

Configuration File Loading: LOAD

Load a configuration file from memory.

- Default file: Default file.
- Press ENTER to activate File selection. UP and DOWN select from Files 0, 1, 2, 3 or Default
- Pressing ENTER accepts the new Configuration File.

Configuration File Saving: SAVE

Save configuration settings to one of 4 memory files. This allows different set-ups to be easily Loaded from file without the need to set up a complete menu's worth of configurations.

- Default file: File 0.
- Press ENTER to activate File selection. UP and DOWN select from Files 0, 1, 2, 3 or Default.
- Pressing ENTER accepts the new Save file.