



# ABB

## The Company

We are an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The UKAS Calibration Laboratory No. 0255 is just one of the ten flow calibration plants operated by the Company, and is indicative of our dedication to quality and accuracy.

EN ISO 9001:2000



Cert. No. Q05907

EN 29001 (ISO 9001)



Lenno, Italy – Cert. No. 9/90A

Stonehouse, U.K.



0255

## Electrical Safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

## Symbols

One or more of the following symbols may appear on the equipment labelling:

	<b>Warning</b> – Refer to the manual for instructions
	<b>Caution</b> – Risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal

	Direct current supply only
	Alternating current supply only
	Both direct and alternating current supply
	The equipment is protected through double insulation

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of the Technical Publications Department.

### Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

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# 1 INTRODUCTION

This Supplement must be read in conjunction with the Instruction Manual supplied with the instrument:

Instrument	Manual Reference
• Model 8231 Fluoride Monitor	– IM/8231
• Model 8232 Ammonia Monitor	– IM/8232
• Model 8236 Nitrate Monitor	– IM/8236
• Model 8237 Carbon Dioxide Monitor	– IM/8237

For repeatable and reliable serial communication to take place between a master (host computer) and slaves (instruments) it is essential that the two conditions detailed in this section are met.

## 1.1 Electrical Connection

A standard method of electrical connection is used between the master and the slaves, with defined voltage levels and characteristics. The transmitter and receiver integrated circuits within the instrument meet the requirements of the EIA (Electronic Industries Association, American) RS485 and RS422 Serial Interface Standards.

The RS422/485 communication standard is used with the following logic levels:

- for logic '1' (MARK condition or IDLE state) the 'A' terminal of the transmitter is negative (0V) with respect to the 'B' terminal (+5V).
- for logic '0' (SPACE condition or ACTIVE state) the 'A' terminal of the transmitter is positive (+5V) with respect to the 'B' terminal (0V).

**\*** **Note.** The 'A' terminal is Tx + or Rx + and the 'B' terminal is Tx – or Rx –.

## 1.2 Protocol

A standard language or protocol must be used in both the master and the slaves for messages (commands and data) to be interpreted and acted upon. To achieve this second condition, Modbus Protocol is utilized on the 8230 Monitor using the Remote Terminal Unit (RTU) mode only.

Two methods of message error checking are used. Parity checking is used, if selected, to detect transmission errors in individual characters.

Parity is used for simple error checking. The parity bit is a one-bit code which is transmitted in addition to the ASCII character. It can detect only one error per character, since two errors may cancel out. Parity is calculated by finding the sum of logic '1's in the character and either:

- setting the parity bit to logic '1' if the sum is odd, or logic '0' if the sum is even, when using even parity.
- or
- setting the parity bit to logic '0' if the sum is odd, or logic '1' if the sum is even, when using odd parity.

Cyclic Redundancy Checking (CRC-16) is used to detect errors in the Master messages and Slave responses. This therefore detects errors in the complete message sent and also the replies.

# 2 PREPARATION

Preparation of the instrument is detailed in the relevant Instruction Manual, with additions as detailed in this Section.

## 2.1 Company Standard Settings

Only those parameters detailed on the customer order are programmed at the factory. If any parameters are unsuitable for the application they can be reprogrammed – see Section 6 of the relevant Instruction Manual. Serial data programming details are given in Section 7 of this manual.

Standard settings for the serial data parameters are as follows:

<b>Instrument Identity</b>	01
<b>Parity</b>	None
<b>Transmission Rate</b>	9600 baud

## 3 INSTALLATION

Observe the limitations outlined in the installation information of the relevant Instruction Manual. The maximum serial data transmission line length for both RS422 and RS485 systems is 1200m.

### 3.1 Serial Communication

#### Adaptors for Personal Computers

An RS422/485 communications adaptor board is required for serial links. It is strongly recommended that the card used has galvanic isolation to protect the computer from lightning damage and increase immunity from noise pick-up from cables.

#### 3.1.1 Five-wire Configuration

The following OPTO22 boards are recommended for use with the 8030 serial instruments:

Part No.	ComputerType
AC24	XT Bus IBM PC compatible
AC24 AT	AT Bus IBM PC compatible
AC34	Microchannel IBM PC.

The following 'jumper' selections are required on OPTO22 boards (usually supplied as the default configuration):

<b>RX &amp; TX</b>	install line termination jumper Install pull-up and pull-down jumpers
<b>CTS &amp; RTS</b>	disable jumper installed.

Select board address and interrupts as described in the OPTO22 manual.

#### 3.1.2 Three-wire Configuration

The adaptor card must have the provision for disabling the transmitter after each message is transmitted, so that bus contention does not occur. This is often implemented by the use of the RTS signal to control the transmitter enable. Consult the adaptor card manufacturer to determine suitability.



**Caution.** Install the pull-up/pull-down resistors on either the RX or TX lines. The resistors **must not** be connected on **both** pairs of lines.

## 4 ELECTRICAL CONNECTIONS

All connections, apart from those for serial data communication, are made as shown in the relevant Instruction Manual.

### 4.1 Serial Connections – Figs. 4.1 and 4.2

The transmitters must be connected in parallel as shown in the schematic diagram – Fig. 4.1. The RS485 standard quotes connection of maximum thirty two slaves (8230 Monitors) to any single driver (computer terminal or host computer); the RS422 standard quotes connection of up to ten slaves. However, these numbers can be increased if the driver's serial port permits.

Make serial data connections and check the output board links as shown in Fig. 4.2. The type of cable used is dependent on the transmission speed and cable length:

#### 4.1.1 Five-wire Cable – Figs. 4.2a and 11.1

**Up to 6m (all speeds)** – standard screened or twisted pair cable.

**Up to 300m** – twin twisted pair with overall foil screen and an integral drain wire, e.g. Belden 9502 or equivalent

**Up to 1200m** – twin twisted pair with separate foil screens and integral drain wires for each pair, e.g. Belden 9729 or equivalent

#### 4.1.2 Three-wire Cable – Figs. 4.2b and 11.2

**Up to 6m (all speeds)** – standard screened or twisted pair cable.

**Up to 1200m** – single twisted pair with overall foil screen and integral drain wire, e.g. Belden 9501 or equivalent.

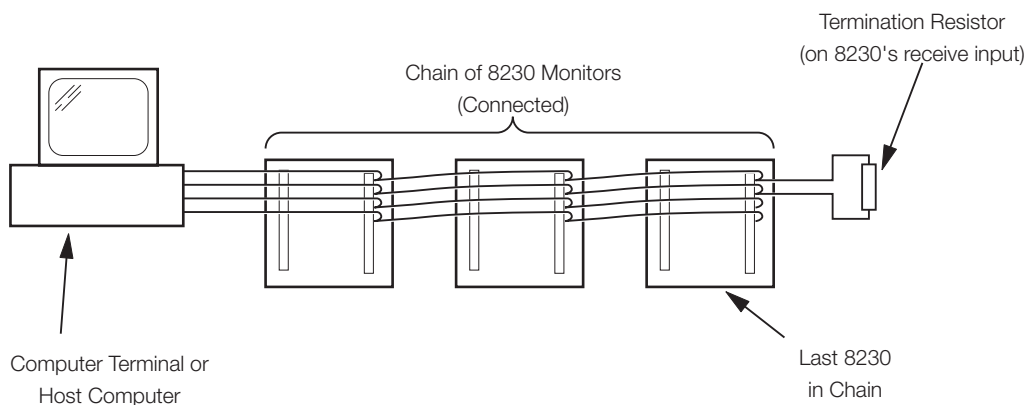


Fig. 4.1 Schematic Diagram

## ...4 ELECTRICAL CONNECTIONS

### ...4.1 Serial Connections

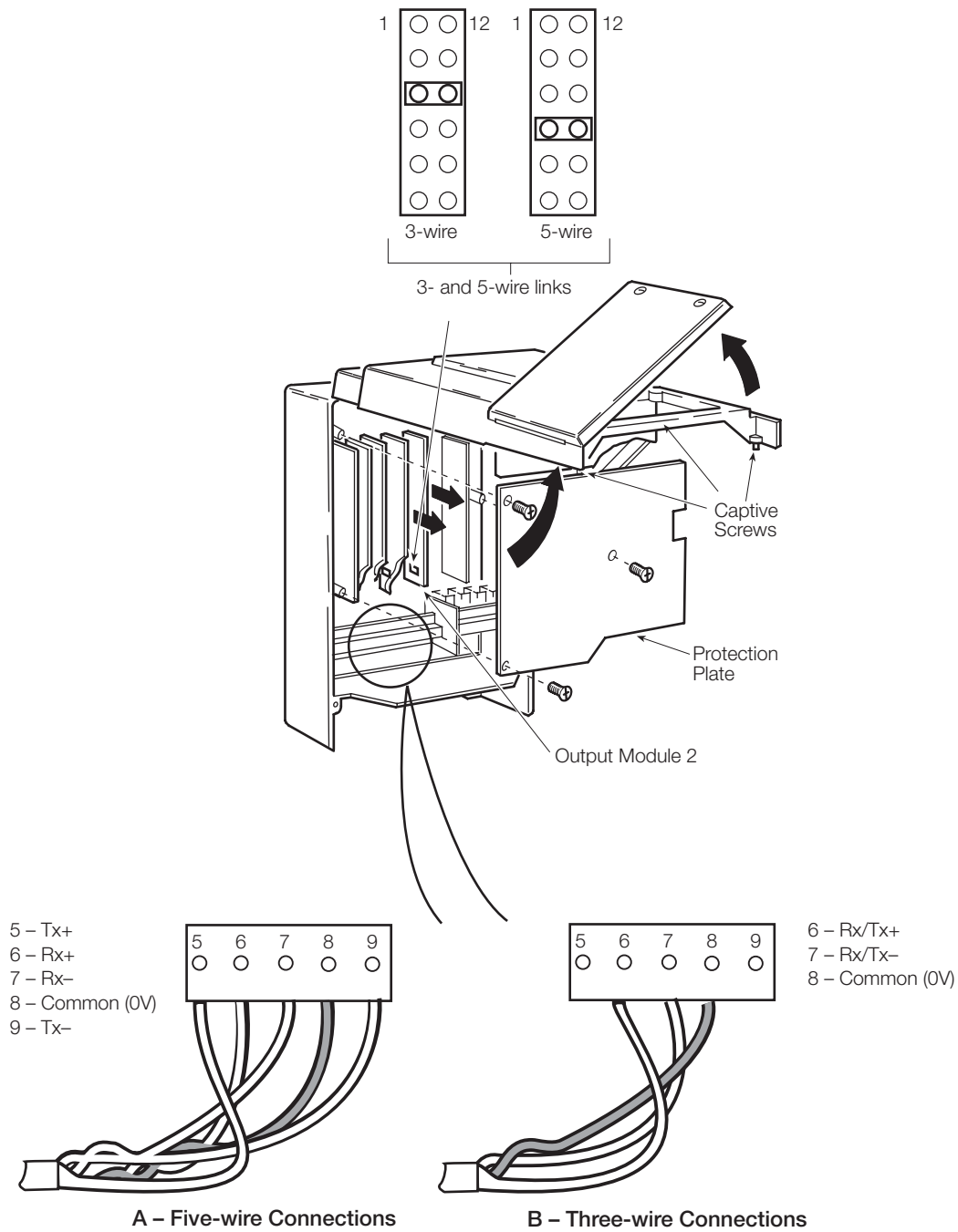


Fig. 4.2 Serial Connections

## 5 SETTING UP

For all aspects other than serial data transmission the transmitter is set up as shown in the relevant Instruction Manual. Unless otherwise requested, the instrument is despatched with a transmission rate of 9600 baud and transmission line termination resistors linked-in. If the resistors are to be linked-out (see Fig. 5.1) carry out the following Section.

### 5.1 Termination Resistors – Fig. 5.1

For long transmission lines, termination resistors are required on the last 8230 Monitor in the chain and at the host computer/ computer terminal. Under normal operating conditions the resistors are required at the last 8230 receive inputs only – see Fig. 4.1. The transmitter's resistors are selected using plug-in links – see Fig. 5.1.

Switch off the supply and gain access to the output board – see relevant Instruction Manual. Set the termination resistor links as shown in Fig. 5.1.

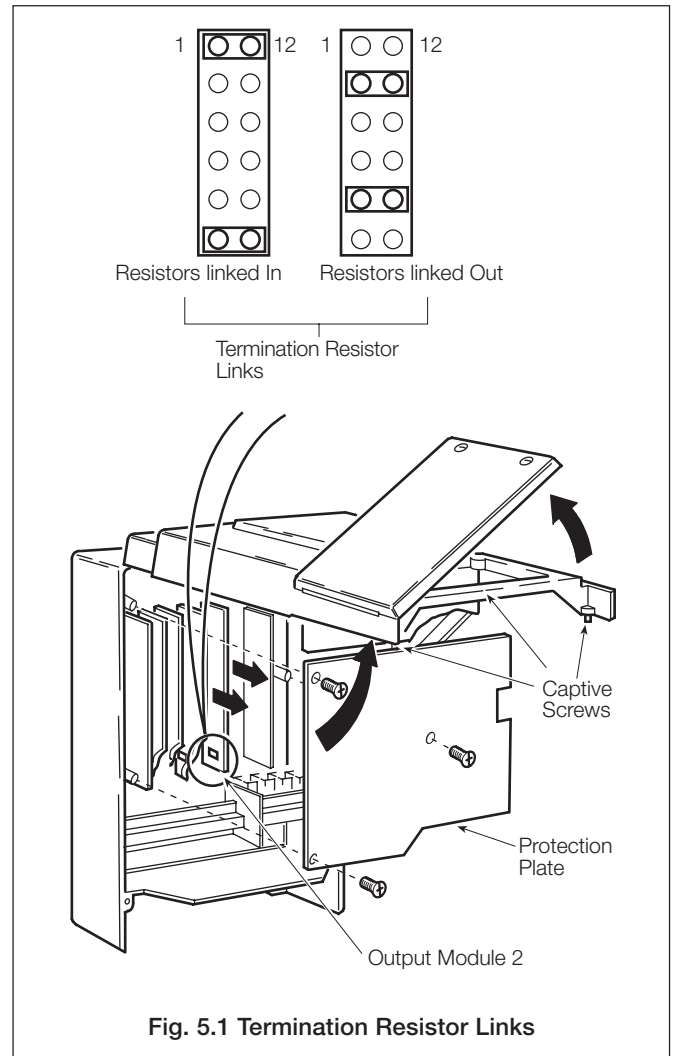
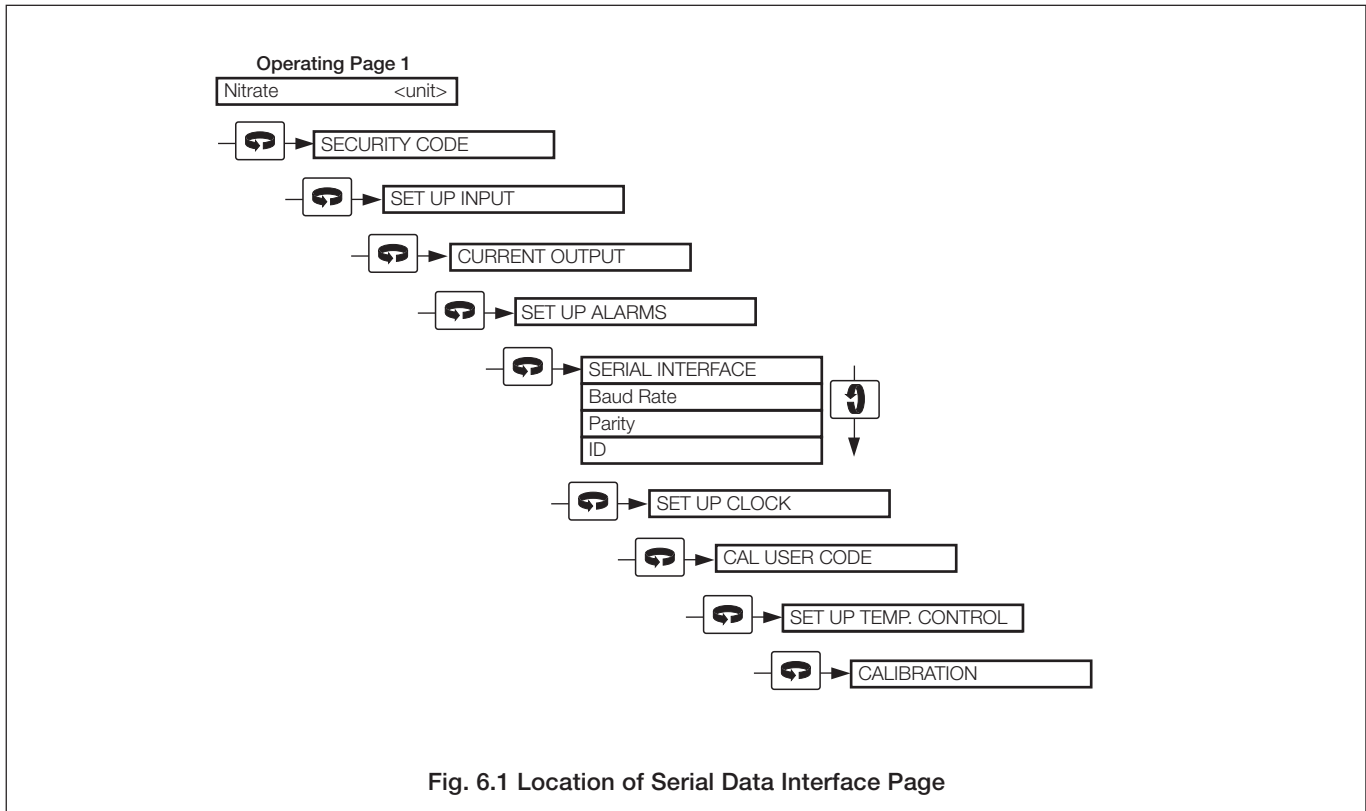


Fig. 5.1 Termination Resistor Links

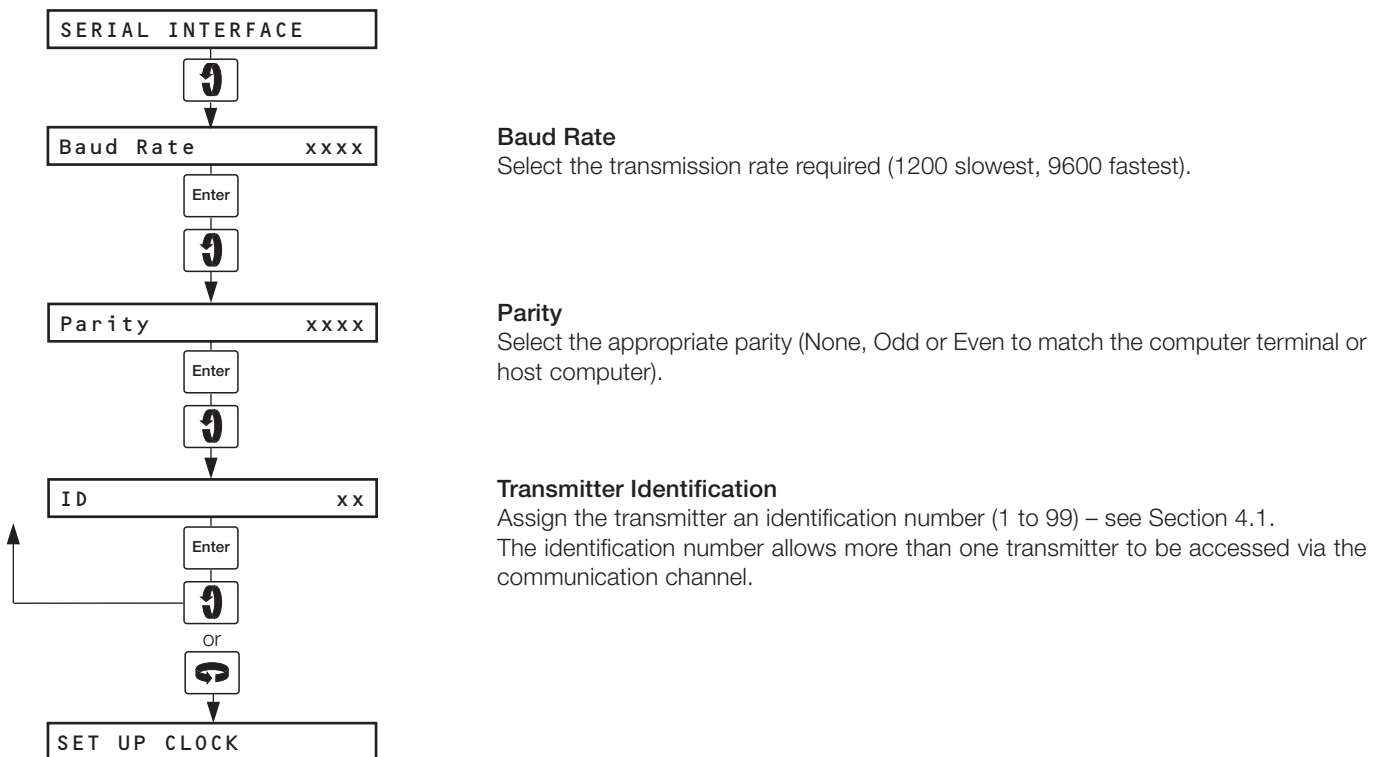
## 6 PROGRAMMING

The general programming procedure is as detailed in the relevant Instruction Manual, but with an additional **Set Up Serial Interface** frame in the **Set Up Instrument** page.



### 6.1 Serial Interface Page

Refer to Section 6 (Programming) in the relevant Instruction Manual.



## 7 MODBUS PROTOCOL

### 7.1 Introduction to Modbus Protocol (RTU only)

Modbus communication is based on a master and a slave arrangement. The master sends a message to one slave at a time and waits for a reply.

The slave cannot accept a new message until the existing message is processed and a reply sent to the master (maximum response time 250 milliseconds). The slave monitors the elapsed time between receipt of characters. If the elapsed time without a new character is  $3\frac{1}{2}$  character times, the slave assumes the next character received is the start of a new message.

To allow the master to differentiate between more than one slave in a system, each slave is given a unique identity address (between 1 and 99).

A broadcast address (address zero) can be used to access all slave devices with one command. This is limited to write messages only and there is no slave acknowledgment.



**Note.** Modbus RTU requires 1 start bit, 8 data bits, 1 parity bit (optional) and 1 or 2 stop bits. The 8230 uses only 1 stop bit.

### 7.2 Modbus Function Codes – Table 7.1

The function code field instructs the addressed slaves which function to perform.

Modbus Function Code	Modbus Message Name	8230 Modbus Definition
01	Read Coil Status	Read up to 16 consecutive discrete (boolean) points from a specific point. The 8230 returns zeros for points which do not contain defined data and NAKs* any request for point numbers greater than 100.
03	Read Holding Register	Up to 8 consecutive registers from a specific starting register. The 8230 returns zeros from registers which do not contain defined data and NAKs* any request for register numbers greater than 100.
05	Force Single Coil	Write one discrete (boolean) point. The 8230 NAKs* this if the point is not currently writeable.
06	Preset Single Register	Write one register. The 8230 NAKs* if the register is not currently writeable. This function code also applies any existing limits to the register before storage in the database.
08	Loopback Diagnostic Test	Echo the message, only 'Return of Query' is supported.
16	Preset Multiple Registers	Write up to 8 consecutive registers from a specified starting register. The 8230 NAKs* if any of the registers are not currently writeable, but still carries out all the writes which are valid, applying any currently applicable limits to the value before storage in the database.

\*NAK = Negative Acknowledgement

**Table 7.1 Modbus Function Codes**


## 8 MODBUS FUNCTIONS

This section shows typical examples of Modbus function codes 01, 03, 05, 06, 08 and 16.

### 8.1 Read Coil Status – Function Code 01

#### 8.1.1 Read Coil Status Query

This function allows the user to obtain the ON/OFF status of logic coils used to control discrete outputs from the addressed slave only. Broadcast mode is not supported with this function code. In addition to the slave address and function fields, the message requires that the information field contain the initial coil offset address to be read (starting address) and the number of locations to be interrogated must obtain status data.

 **Note.** The coil offset address is the coil number minus one, e.g. to start at coil 33 the data start value must be set to 32 (20H).

**Example** – a read coil status request to read 5 coils from slave (01) starting at coil 33 (Out of Sample) is shown below.

Address	Function	Coil Start Offset High	Coil Start Offset Low	Number of Coils High	Number of Coils Low	Error Check Field (CRC-16)	
01	01	00	20	00	05	FD	C3

#### 8.1.2 Read Coil Status Response

The data is packed one bit for each coil (1 = ON, 0 = OFF). The response includes the slave address, function code, quantity of data characters, the data characters and error checking. The low order bit of the first character contains the first addressed coil and the remainder follow. For coil quantities that are not even multiples of eight, the last characters are filled in with zeros at high order end.

**Example** – the response to the read coil status query shows the following:

Monitor Out of Sample  
Temperature Control Error  
Ion Input Error  
Temperature Input Error  
Hold Mode

### 8.2 Read Holding Register – Function Code 03

Address	Function	Byte Count	Data Coil Status 33 to 37	Error Check Field (CRC-16)	
01	01	01	06	D1	8A

#### 8.2.1 Read Holding Register Query

The Read holding registers allow the user to obtain the binary contents of holding registers in the addressed slave.

 **Note.** The data start register must contain the offset address of the first register to be accessed, e.g. to start at register 01 the data start register must contain 00 (00H).

Broadcast mode is not allowed.

**Example** – a read holding register request to read 4 holding registers from slave (01) starting at holding address 01 (Ion Value) is shown below.

Address	Function	Register Start Offset High	Register Start Offset Low	Data Number of Registers High	Data Number of Registers Low	Error Check Field (CRC-16)	
01	03	00	00	00	04	44	09

### 8.2.2 Read Holding Register Response

The addressed slave responds with its address and function code, followed by the information field. The information field contains 1 byte describing the quantity of data bytes to be returned. The contents of each register requested (DATA) is two bytes, the first byte includes the high order bits and the second the low order bits.

**Example** – the response to the read holding register query shows the following:

Ion Value = 673 mg Kg<sup>-1</sup>  
 Measured millivolts = -0.7 mV  
 Measured Temperature = 45.1°C  
 Slope = 100.2%

Address	Function	Byte Count	Holding Register 11		Holding Register 12		Holding Register 13		Holding Register 14		Error Check Field (CRC-16)	
			High	Low	High	Low	High	Low	High	Low		
01	03	08	0A	B2	07	FC	04	AE	08	04	B0	D2

### 8.3 Force Single Coil – Function Code 05

#### 8.3.1 Force Single Coil Query

This message forces a single coil either ON or OFF. The data value 65,280 (FF00 HEX) sets the coil ON and the value zero turns it OFF. All other values are illegal and do not affect the coil.



**Note.** To write to a coil the coil offset address must be used, e.g. to write to coil 20, the coil address 19 (13H) is transmitted.

The use of slave address zero (broadcast mode) forces all attached slaves to modify the desired coil.

**Example** – a force single coil request to switch ON coil address20 (NV Memory Save) in slave 01 is shown below.

Address	Function	Coil Offset High	Coil Offset Low	Data Value High	Data Value Low	Error Check Field (CRC-16)	
01	05	00	13	FF	00	7D	FF

#### 8.3.2 Force Single Coil Response

The response is confirmation of the query after the coil state has been altered.

**Example:**

Address	Function	Coil Offset High	Coil Offset Low	Data Value High	Data Value Low	Error Check Field (CRC-16)	
01	05	00	13	FF	00	7D	FF

## ...8 MODBUS FUNCTIONS

### 8.4 Preset Single Register – Function Code 06

#### 8.4.1 Preset Single Register Query

The preset single register allows the user to modify the contents of a holding register.



**Note.** Function codes 5, 6 and 16 are the only messages that are recognized as valid for broadcast.

**Example** – a preset single register request to write the value 500 to holding register address 35 (Set point A1) in slave 01 is shown below.

Since all register values for measured variables and alarm set points are ranged to 12 bits (for RTU), then to calculate the Data Value High and Data Value Low for a setpoint of 500 the following method is used:

Instrument Range = 10 to 1000 (10 = minimum range, 1000 = maximum range)

therefore 
$$\frac{(500 - \text{min. range}) \times 4095}{(\text{max. range} - \text{min. range})}$$

$$= \frac{(500 - 10) \times 4095}{990} = 2026_{10}$$

converted to hexadecimal  $2026_{10} = 7EA_{16}$

therefore Data Value High = 07

Data Value Low = EA



**Note.** To write to a register, the register's offset address must be used, e.g. to write to register 35, the offset address 34(22) is transmitted.

Address	Function	Register Offset High	Register Offset Low	Data Value High	Data Value Low	Error Check Field (CRC-16)	
01	06	00	22	07	EA	AA	7F

#### 8.4.2 Preset Single Register Response

The normal response to a preset single register request is to retransmit the query message after the register has been altered.

**Example:**

Address	Function	Register Offset High	Register Offset Low	Data Value High	Data Value Low	Error Check Field (CRC-16)	
01	06	00	22	07	EA	AA	7F

## 8.5 Loopback Test – Function Code 08

### 8.5.1 Loopback Test Query

The purpose of the loopback test is to test the Modbus system, it does not affect the content of the controller. Variations in the response may indicate faults in the Modbus system. The information field contains 2 bytes for the designation of the diagnostic code followed by 2 bytes to designate the action to be taken.

Example:

Address	Function	Register Offset High	Register Offset Low	Data Value High	Data Value Low	Error Check Field (CRC-16)	
01	08	00	20	04	02	62	C0

### 8.5.2 Loopback Test Response

The response always echoes the query, only diagnostic code 0 (bytes 3 and 4) can be used.

Example:

Address	Function	Data Diagnostic Code High	Data Diagnostic Code Low	Data*	Data*	Error Check Field (CRC-16)	
01	08	00	20	04	02	62	C0

\* These are considered to be the information fields for diagnostic mode.

## 8.6 Preset Multiple Registers – Function Code 16

### 8.6.1 Preset Multiple Registers Query

Holding registers existing within the controller can have their contents changed by this message. When used with slave address zero (Broadcast mode) all slave controllers load the selected registers with the contents specified.



**Note.** To write to multiple registers, the initial register offset address must be used, e.g. to write to register 02 onwards, the offset address 01 is transmitted.

**Example** – a preset multiple registers request to write the value 10 to the register address (Standard 1) and the value 1000 to the register address (Standard 2) in slave 01 is shown below.

Address	Function	Register Start Offset		Number of Registers	Byte Count	Holding Register 02		Holding Register 03		Error Check Field (CRC-16)		
		High	Low			High	Low	High	Low	High	Low	
01	10	00	31	00	02	04	00	00	0F	FF	74	C7

### 8.6.2 Preset Multiple Registers Response

The response confirms slave identification, function code, starting register address and quantity only.

Example:

Address	Function	Register Start Offset High	Register Start Offset Low	Number of Registers		Error Check Field (CRC-16)	
01	10	00	31	00	02	10	07

## 9 EXCEPTION RESPONSES

The exception response codes sent by the slave are shown in Table 9.1. When a slave detects one of these errors, it sends a response message to the master consisting of slave address, function code, error code and error check fields.

Exception Response Code	Exception Response Name	Exception Response Definition
01	Illegal Function	The message function received is not an allowable action for the instrument.
02	Illegal Data Address	The address reference in the data field is not an allowable address for the instrument.
03	Illegal Data Value	The value referenced in the data field is not allowable in the addressed slave location.
07	Negative Acknowledgement	The function just requested cannot be performed.
08	Memory Parity Error	Parity check indicates an error in one or more of the characters received.

**Table 9.1 Exception Response Data**

### 9.1 Examples

A read register request to read holding register address 251 of slave 01 (undefined address for slave, beyond address limit) is shown below.

Slave Address	Function	Register Start Offset		Number of Registers		Error Check Field (CRC-16)	
		High	Low	High	Low		
01	03	00	FA	00	06	E5	F9

The response is an exception response sighting 'illegal data address'. To indicate that the response is a notification of an error, the most significant bit of the function code is set to 1.

Slave Address	Function	Exception Code	Error Check Field (CRC-16)	
01	83	02	C0	F1

## 10 MODBUS COILS AND REGISTERS

### 10.1 Coils

Input Number		Read/Write	Description	Response/Entry
Decimal	Hex			
1	\$01	R/W	Autocalibration	0 = OFF 1 = ON
10	\$0A	R/W	Initiate Manual Calibration	0 = - 1 = Initiate
20	\$14	R/W	NV Write	0 = Disable 1 = Enable
30	\$1E	R	Calibration in Progress	0 = No 1 = Yes
31	\$1F	R	Slope error	0 = No 1 = Yes
32	\$20	R	Slow error	0 = No 1 = Yes
33	\$21	R	Out of sample	0 = No 1 = Yes
34	\$22	R	Temperature control error	0 = No 1 = Yes
35	\$23	R	Ion input error	0 = No 1 = Yes
36	\$24	R	Temperature input error	0 = No 1 = Yes
37	\$25	R	Hold mode	0 = Off 1 = On
38	\$26	R	Out of service	0 = No 1 = Yes
40	\$28	R	Alarm 1 Relay	0 = De-energized 1 = Energized
41	\$29	R	Alarm 2 Relay	0 = De-energized 1 = Energized

## ...10 MODBUS COILS AND REGISTERS

### 10.2 Holding Registers

Input Number		Read/Write	Description	Response/Entry
Decimal	Hex			
1	\$01	R – Note (1)	Ion Value	Ion value
2	\$02	R – Note (2)	Measured millivolts	–400 to +400 mV
3	\$03	R – Note (3)	Measured temperature (°C)	–10 to 110°C
4	\$04	R – Note (4)	Slope (%)	0% to 200%
5	\$05	R – Note (3)	Control temperature	30 to 45°C
10	\$0A	R	Instrument type	0: Fluoride (8231 only) 1: Ammonia (8232 only) 2: Nitrate (8236 only) 4: CO <sub>2</sub> (8237 only)
11	\$0B	R	Display as	0: Fluoride (8231 only) 1: Ammonia 2: Ammonium 3: Nitrogen (Ammo.) } (8232 only) 4: Nitrate 5: Nitrogen (Nitr.) } (8236 only) 6: CO <sub>2</sub> (8237 only)
12	\$0C	R	Ion units	0: mg/kg1: mg/l 2: ppm
13	\$0D	R	Display zero	See table 10.1 } *
14	\$0E	R	Display FSD	See table 10.1 }
20	\$14	R	OP1 cal hold	0: No 1: Yes
21	\$15	R	OP1 law	0: Lin 1: Log
22	\$16	R – Note (1)	OP1 FSD	Ion value
23	\$17	R – Note (1)	OP1 Zero	Ion value
30	\$1E	RW	Enable A1	0: Disable 1: Enable
31	\$1F	R	Alarm action A1	0: Below 1: Above
32	\$20	R	Failsave A1	0: Not failsafe 1: Failsafe
33	\$21	R	Hysteresis A1	0 to 5%
34	\$22	R	Delay A1	0 to 60 min
35	\$23	RW – Note (1)	Setpoint A1	Ion value
40	\$28	RW	Enable A2	0: Disable 1: Enable
41	\$29	R	Alarm action A2	0: Below 1: Above
42	\$2A	R	Failsave A2	0: Not failsafe 1: Failsafe
43	\$2B	R	Hysteresis A2	0 to 5%
44	\$2C	R	Delay A2	0 to 60 min
45	\$2D	RW – Note (1)	Setpoint A2	Ion value
50	\$32	RW – Note (1)	STD1	Ion value
51	\$33	RW – Note (1)	STD2	Ion value



#### Notes.

- Look up the number returned by the instrument in the first column of Table 10.1 and read off the related FSD and Zero values.
- Not applicable to 8237 CO<sub>2</sub> instruments. On the 8237, zero is fixed at 0.1 and span is fixed at 1000.

...10.2 Holding Registers

Input Number		Read/Write	Description	Response/Entry
Decimal	Hex			
60	\$3C	RW	Day	1 to 31
61	\$3D	RW	Month	1 to 12
62	\$3E	RW	Year	0 to 99
63	\$3F	RW	Hour	0 to 23
64	\$40	RW	Minutes	0 to 59
70	\$46	RW	Day for next calibration	1 to 31
71	\$47	RW	Month for next calibration	1 to 12
72	\$48	RW	Year for next calibration	0 to 99
73	\$49	RW	Hour for next calibration	0 to 23
74	\$4A	RW	Minutes for next calibration	0 to 59
75	\$4B	RW – Note (5)	Calibration interval	0 to 8
76	\$4C	R	Day last calibration	1 to 31
77	\$4D	R	Month last calibration	1 to 12
78	\$4E	R	Year last calibration	0 to 99



**Notes.**

1. On all instruments except 8237 – scaled from 0 to 4095, for actual min. and max. value see Table 10.1. On 8237 instruments, min = 0.1 and max = 1000.0
2. -400mV = 0 and +400mV = 4095
3. -10°C = 0 and 110°C = 4095
4. 0% = 0 and 200% = 4095
5. 0: 6 Hours  
 1: 12 Hours  
 2: 1 Day  
 3: 2 Days  
 4: 3 Days  
 5: 4 Days  
 6: 5 Days  
 7: 6 Days  
 8: 7 Days

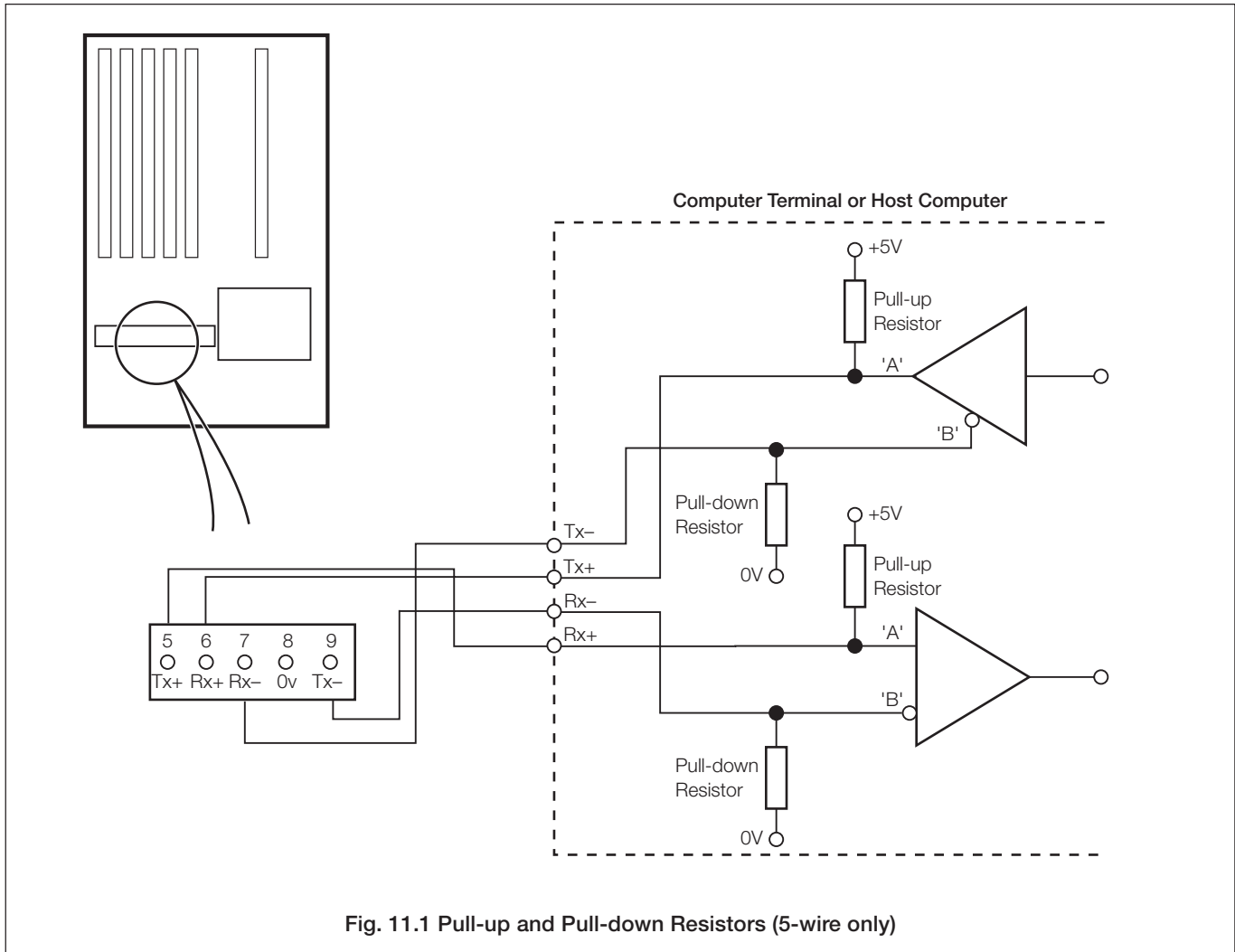
No	Decade	Value for 0 (\$0000)	Value for 4095 (\$0FFF)
9	0.050 to 5.000	0.05	5.000
8	0.10 to 10.00	0.10	10.00
7	0.20 to 20.00	0.20	20.00
6	0.50 to 50.00	0.50	50.00
5	1.0 to 100.0	1.0	100.0
4	2.0 to 200.0	2.0	200.0
3	5.0 to 500.0	5.0	500.0
2	10 to 1000	10	1000

Table 10.1 FSD and Zero Values

## 11 OPERATION

Before attempting any serial communication, first ensure that the 8230 Monitors connected to the computer terminal or host computer by serial link are functioning correctly as individual instruments.

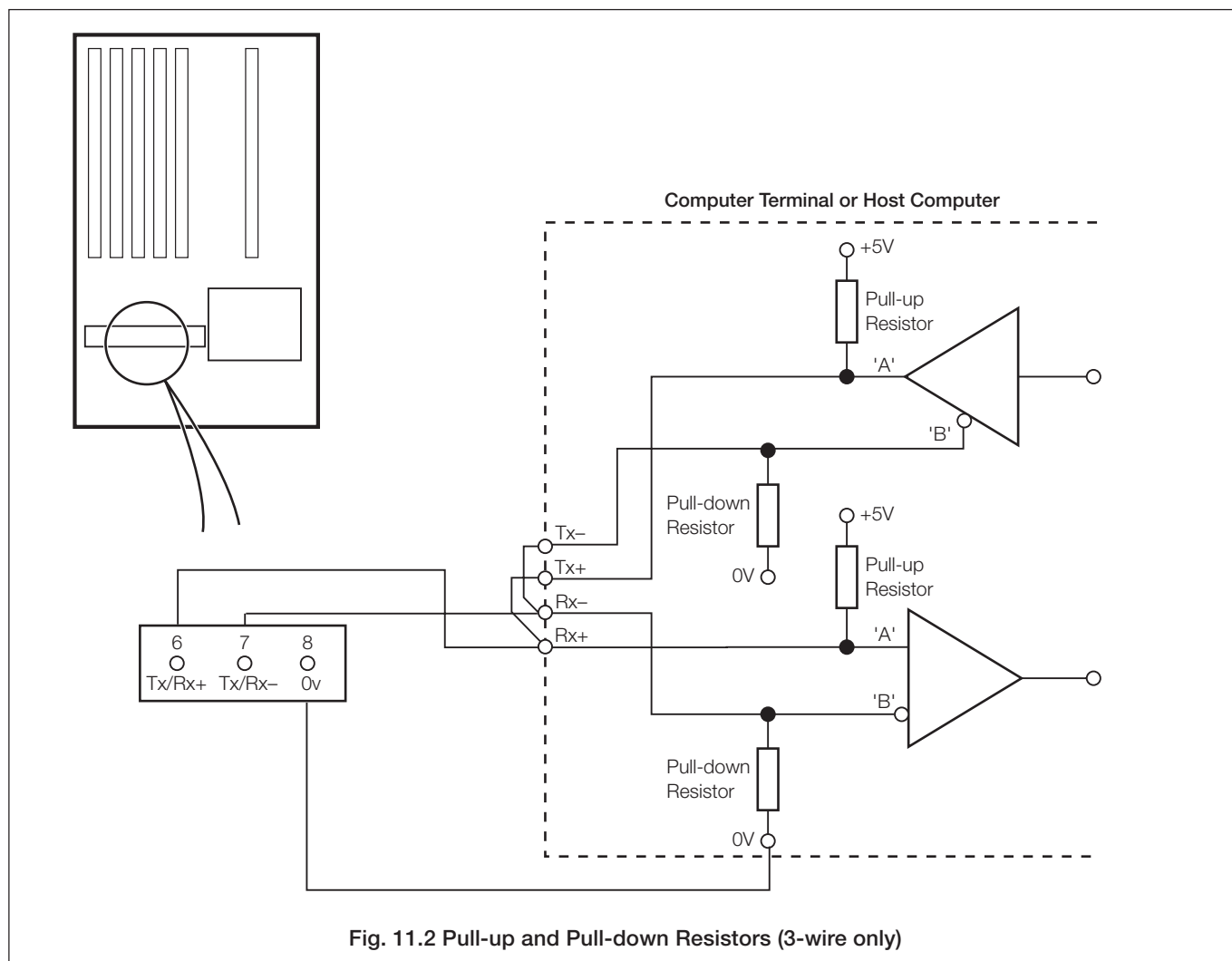
Ensure that the serial data connections to the 8230 Monitor have been made correctly with respect to the computer terminal, or host computer, interface. If the above check appears satisfactory, test the serial communication by sending an appropriate message from the computer terminal or host computer to a transmitter and observe if it replies; thus establishing communication. If communication is not established, check that the computer terminal, or host computer, interface is set up correctly and that the plug-in links within each transmitter are correctly positioned – see Section 5.



Check that the parameters programmed in the instrument's **Serial Data Communication Page** are compatible with those of the computer terminal or host computer – see Section 7.

If communication is still not possible or is erratic, check that the computer terminal, or host computer, interface has pull-up and pull-down resistors connected as shown in Figs. 11.1 and 11.2.

**Note.** If no reply is received from the instrument within 160ms, retransmit the command. If after five command re-entries a satisfactory reply has not been received, the communication link has been broken and must be re-checked.



## 12 SPECIFICATION

As detailed in the relevant Instruction Manual, with the following additions:

EIA Communication Standards	RS422, RS485 2-wire or 4-wire modes	
Parity	None Odd Even	} Programmable
Transmission line length	1200m max.	
Transmission speeds	1200 baud 2400 baud 4800 baud 9600 baud	} Programmable

## APPENDICES

### A1 Non-volatile Memory Limitations



**Note.** If the number of write cycles to any particular non-volatile memory register exceeds  $10^4$ , the register's contents may not be retained.

Any changes made to a parameter, e.g. Alarm trip value, via the serial link are stored in a non-volatile memory register assigned to that parameter.

The number of write cycles to a particular register can be reduced by disabling the non-volatile memory access when making changes to parameters which do not need to be saved on power-down. This is done by using the **non-volatile save state (coil number 20)**.

When the **non-volatile save state** is set to 'Enable', any parameter changes made via the serial link are written to the non-volatile memory register and retained on power-down. If the **non-volatile save state** is set to 'Disable', parameter changes made via the serial link are not retained on power-down.

The **non-volatile save state** is not retained on power-down and must be reset to the required state each time the instrument is powered down, replaced with another instrument or the host computer is powered down.

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## NOTES

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#### Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification.

Periodic checks must be made on the equipment's condition. In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of all storage, installation, operating and maintenance records relating to the alleged faulty unit.

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