Druck

Pressure Measurement

Druck Limited
Fir Tree Lane, Groby, Leicester
LE6 0FH, England.

Telephone Leicester (0533) 314314
Telex 341743 Facsimile (0533) 875022

DPI 510
RS232 OPTION
HANDBOOK
K086B

K086B Issue No. 1

SAFETY

1 This publication contains information and warnings that must be followed to ensure the safe operation of the instrument. Further information and warnings are contained in the main handbook for this instrument.

2 The operator must not use this equipment for any other purpose than that stated. Do not apply a pressure greater than the maximum pressure stated. This equipment is designed to be used with dry air or nitrogen in a gaseous state; do not use any other medium without first consulting DRUCK.

3 Do not apply a pressure greater than 10% of the full scale pressure in the selected pressure range of the unit. If an excessive pressure, greater than that stated, is applied, personnel can possibly receive injures that could in extreme circumstances be lethal. Furthermore possible serious damage can occur to the instrument and the user system and equipment.

Associated DRUCK Publications

K086	DPI 510 Precision Pressure Controller/Calibrator Operation and Maintenance Handbook
K087	Function Key Summary Card
K086A	IEEE 488 Option Handbook
K087A	IEEE 488 Summary Card
K087B	RS232 Summary Card
K086C	Sensor Conditioning Module Option Handbook
K087C	SCM Summary Card
K086D	Analogue Output Option Handbook

CONTENTS

DPI 510
PRECISION PRESSURE CONTROLLER/CALIBRATOR

RS232 Option

The RS232 Option is a standard instrument interconnection system which will allow data to be sent to the instrument from a suitable control computer or terminal. It is possible to return data from the instrument on command or continuously.

The option operates in three modes Direct, Printer and Addressed. In the Direct and Addressed mode the instrument is connected by either a point-to-point or networked link to an "intelligent" controller (control computer). In the Printer mode the instrument provides data spontaneously on a timed basis to drive a "non-intelligent" peripheral such as a printer. Addressed Mode, allows the instrument to form part of a "Druck Daisy-Chain" network, responding to commands specifically addressed to that instrument. Direct Mode is used with point-to-point connection between the instrument and a controller employing a simplified control format.

Data from the instrument can be in Computer Format compatible with computer interfacing. For diagnostic work or direct operation from a VDU, a Dialogue Output Format is available which sends data as plain English text.

1 GENERAL DESCRIPTION

The RS232 Option emulates the functions of the IEEE 488 Option. This means that the instrument which is usually controlled from the front panel when in LOCAL Mode, can be set to REMOTE Mode and controlled via an RS232 serial link.

Selection of LOCAL and REMOTE Modes are made by control code, via the option. In LOCAL Mode only, the key-pad has full control whilst the readings and status may be requested by the option. In REMOTE Mode the key-pad is disabled and the full range of control codes are available via the RS232 Option.

In common with IEEE bus the RS232 Option, when in ADDRESSED Mode, must be commanded to be in TALK or LISTEN Mode. The TALK command will illicit data from the instrument. In the LISTEN Mode the instrument receives data from the Control Computer. Whilst using ADDRESSED Mode, the IEEE SECONDARY ADDRESSING may also be used for access to other options.

When the RS232 Option is in the DIRECT Mode, neither packet address nor TALK/LISTEN commands are required. The control codes, however, remain the same as those of the IEEE Option. In this case data is requested from the instrument by a <CR> (carriage return) character.

In PRINTER Mode, no stimulus is required from a Control Computer. Instead the output of data is on a timed basis. This enables the instrument to be used to log results onto a printer or terminal.

The output format can be selected to COMPUTER or DIALOGUE. The COMPUTER format is a mnemonic system convenient for interfacing with a Control Computer. The DIALOGUE format provides data in English text for direct display on a terminal or printer.

2 INSTALLATION

2.1 General

The following section contains the procedure to install the RS232 option into the DPI 510. The RS232 connector appears on the instrument rear panel after option installation.

NOTE: The main instrument software must be to issue 5 or later. The issue number is shown on the EPROM label.

WARNING

VOLTAGES IN EXCESS OF 30 VOLTS(RMS) AC OR 50 VOLTS DC CAN, IN CERTAIN CIRCUMSTANCES BE LETHAL. CARE MUST BE TAKEN WHEN WORKING ON LIVE, EXPOSED CONDUCTORS.

WARNING

COMPRESSED GAS CAN, IN CERTAIN CIRCUMSTANCES BE LETHAL. WHEN CONNECTING AND DISCONNECTING COMPRESSED GAS SUPPLY LINES, ENSURE THAT THE SOURCE PRESSURE IS TURNED OFF AND THE PRESSURE LINES ARE VENTED. PROCEED WITH CARE

2.2 Procedure

To install the RS232 serial interface option proceed as follows:

a. Ensure that electrical power and pneumatic pressure is disconnected from the unit.

b. Unscrew and remove the four screws securing the top cover.

c. Unscrew and remove the upper three screws securing the blanking plates or installed option cards and collect the retaining bar from the inner face of the rear panel.

d. Unscrew and remove the lower screw securing Option 1 blanking plate and collect the blanking plate.

e. Carefully align the RS232 option card with connector ANALOGUE OPTION SK2 or DIGITAL OPTION SK3 of the unit motherboard, firmly connect the option card.

f. Secure the option card with the two locking plungers.

g. Secure the option card with the lower screw.

h. Locate and align the retaining plate and secure the blanking plates or option cards with the upper three screws.

i. Refit the top cover with the four screws.

j. Connect a compatible RS232 device to the rear panel D-type connector as detailed in paragraph 2.3.

k. Install and connect the unit as detailed in INSTALLATION of Operation and Maintenance Handbook K086.

2.3 Using the System

To use the system:

1. Choose the **interconnection method**:

   a. **Point-to-Point**, single instrument connected to a control computer or printer.

   OR

   b. **Druck Daisy-Chain Network**, allows several instruments connected in series or an individual instrument to a control computer. The instruments must be set to the Addressed Mode, each instrument address is programmable from 0 to 99.

      In the Addressed Mode, the instrument must be commanded to LISTEN before acting on any control codes. A TALK command causes the addressed device to send a reading. All other talking devices are disabled from talking.

2. Choose the **Output Format:**

   a. **Computer Format**

      In the Computer Format, a rigorous alpha-numeric system of status conditions and readings are sent by the instrument.

      NOTE: Cannot be used in Printer Mode.

   OR

b. **Dialogue Format**

All data, except some Option messages, is returned in plain English text.

3. Choose the **Handshaking Method:**

a. **Software Handshaking**

Pins 4 and 5 (RTS and CTS) are not connected which reduces the number of connections between instruments. Under high levels of interference this system may lead to corrupted data and even system lock-up. This possibility increases using the Druck Daisy-Chain for which Hardware Handshaking is recommended.

OR

b. **Hardware Handshaking**

This system employs the RTS and CTS signals from the instruments to control data flow. See paragraph 2.3.4 for further details. When hardware handshaking is employed software handshaking should be disabled using the Option SET-UP.

2.3.1 Point-to-Point Connection (Figure 1)

Connect the control computer or printer to the D-type connector as follows:

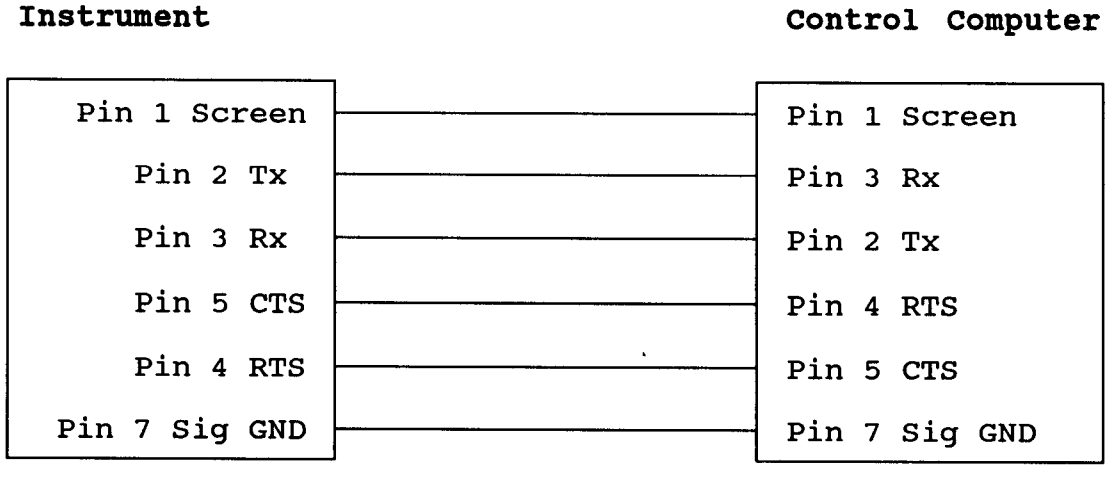
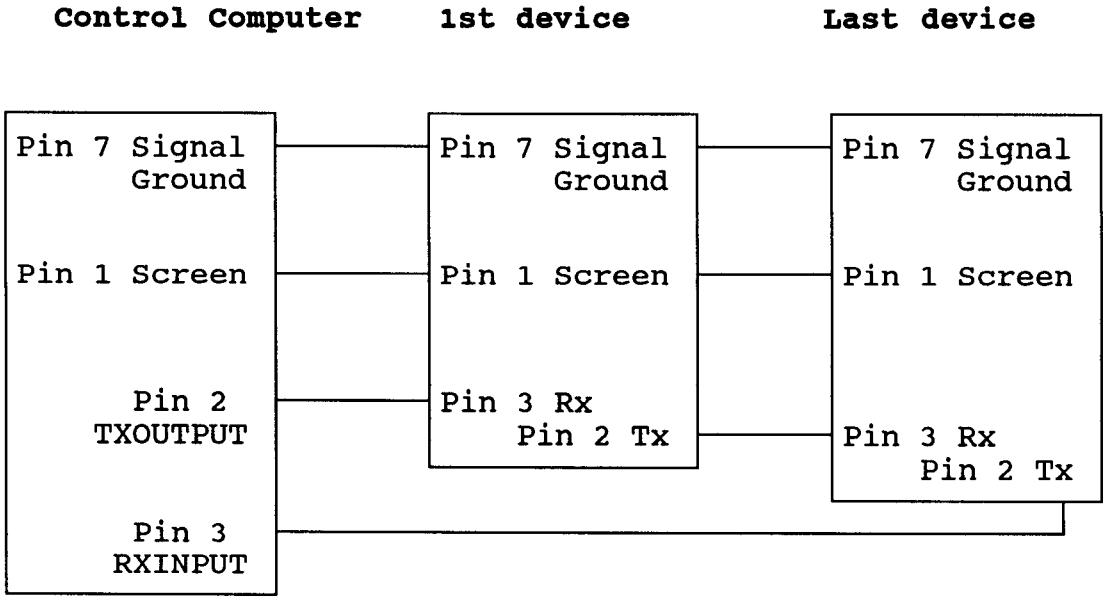


Figure 1 Direct Mode Connections

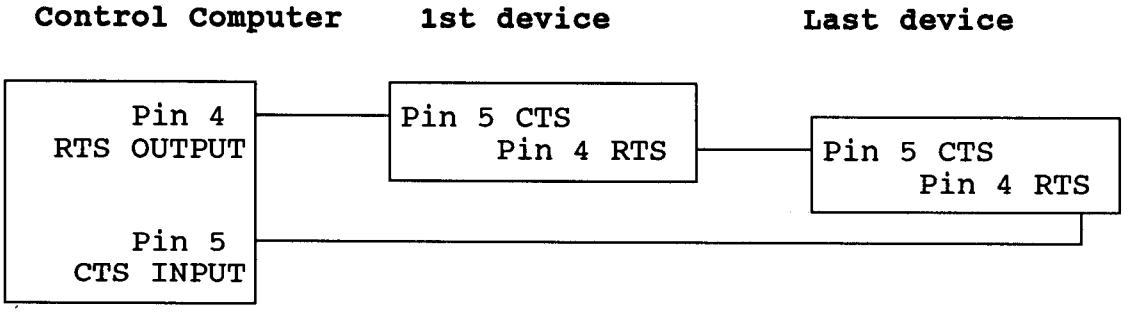
2.3.2 Druck Daisy-Chain Network Connection

Using the Druck Daisy-Chain, a number of instruments can be linked to a control computer by a network. Each instrument on the network has a unique address and the control computer uses this address to communicate with the instrument.

The interconnection for the Druck Daisy-Chain is as follows:



Optional flow control



2.3.3 Testing the Daisy-Chain

To ensure that the Daisy-Chain is complete without affecting settings of any instrument, the block format can be sent.

The format is:

<Block Header><Data><Block Terminator>

Where:

Block Header	=	{
Data	=	Any valid data
Block Terminator	=	}

The data should be echoed back to the Control Computer. It proves that the Daisy-Chain is correctly connected, all instruments are set to the correct baud rate, parity and mode.

2.3.4 Flow Control

Flow Control in the Direct and Printer Mode

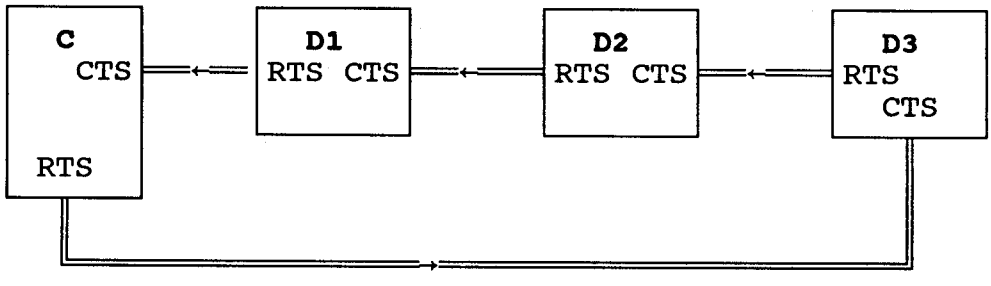
Software or Hardware Handshaking can be used. Using Software Handshaking, when the instrument receives "XOFF" data the transmission of data will stop and only restart when "XON" is received. The instrument sends "XOFF" when the internal buffer is within five characters of full and sends "XON" when the buffer is within five characters of empty.

Using Hardware Handshaking, when the CTS input is high the instrument transmits data. When the internal buffer is within five characters of full, the instrument makes the RTS output low. The instrument makes the RTS output high when the buffer is within five characters of empty.

Flow Control in the Addressed Mode

Hardware and Software Handshaking may be employed in Addressed Mode, but when using the Druck Daisy-Chain, Hardware Handshaking is preferred. When using Software Handshaking the instrument, on receiving a XOFF character, halts data transmission from the buffer and passes on the XOFF character to the next instrument in the chain. When the instrument receives an XON character, data transmission from the buffer will continue after first passing on the XON character. The last instrument in the loop should be set to block the command from returning to the control computer.

When using Hardware Handshaking control flow is as follows:



"D1" - "D3" are three instruments in the Druck Daisy-Chain and "C" is the control computer. An instrument will only activate its RTS line if:

i. It is ready to accept data,

AND

ii. the input CTS is high indicating that all downstream instruments are also ready to accept data.

If either of these conditions is not met, the instrument detecting the condition makes the RTS signal line go low. The data transmission in the system will stop as the low RTS signal passes through the system.

2.3.5 Link Parameters

Set the Link Parameters of the instrument (see 2.4.2) to meet the system requirements and to match the Control Computer settings:

Baud Rate	-	adjustable between 110 and 19200 baud.
Parity	-	odd, even or none.
Data Bits	-	8
Stop Bits	-	1
Start Bits	-	1
Handshaking	-	Software or Hardware.

2.4 Default Settings

On power-up the instrument defaults are set according to the fixed parameters of paragraph 2.4.1. These may be modified while the instrument is operating but will not be stored when the instrument is switched off. Default settings in 2.4.2 may be modified during operation and will be stored at switch-off.

2.4.1 Fixed Default Settings

On power-up the instrument will initially be in local mode with all parameters in the following states:

N0	Notation code
D0	Transmit pressure reading
F00	All functions off
I0	No interrupts
J2	Max rate
@1	Enable error reporting
R0	Range 1 and Local mode
S0	Scale 0
W002	Settling time - 2 seconds
C0	Controller off

2.4.2 Changeable Default Settings

The "initial" settings of the changeable defaults are as follows:

Address = 16
Terminator = <CR LF>
Mode = Direct
Baud Rate = 9600
Parity = Odd
Output Format = Computer
Printer "N" value = 1
End Device = No
Software Handshaking = Disabled

The default address, default string termination characters and default baud rate can be programmed via the front panel as follows:

1. Switch the unit ON, enter SET-UP mode and the PIN (Personal Identification Number) as detailed in the Operation and Maintenance Handbook K086.

2. Select "Option". The message panel will display the options fitted to the unit. Selecting NEXT will step through the available options.

3. Select the RS232 Option and SET-UP.

4. Select ALTER to change the instrument address, NEXT to select the output string termination characters.

5. Select ALTER to step through the string terminator characters. NEXT selects the mode.

6. Select ALTER to step through the modes: Direct, Addressed or Printer. NEXT selects baud rate.

7. Select ALTER to step through baud rate. NEXT selects parity.

8. Select ALTER to step through parity. NEXT selects Output Format.

9. Select ALTER to select the Output Format:

   Computer or Dialogue. NEXT selects printer N value.

10. Select ALTER to change the printer N value. This should be a value between 1 and 9999 inclusive. The number represents the printer reading up date value. NEXT selects the end device.

11. Select ALTER to change the end device status. YES informs the instrument that it is the end device of the "Daisy-Chain". NEXT selects software handshaking.

12. Select ALTER to enable/disable software handshaking. QUIT selects exit.

13. Select Quit again to exit SET-UP.

3 CONTROL CODES

The following section describes the control codes which may be sent to the instrument. Shared codes are those which may be used in any of the three modes (Direct, Printer and Addressed). Mode specific control codes are detailed in the subsequent paragraphs.

3.1 Control Code Format

All values are coded as the ASCII equivalent commands and may be sent individually or in strings.

Symbols used to describe these ASCII codes are:

< > contain a parameter which is further defined.

" " contain actual ASCII characters to be transmitted.

The string format is:

<CONTROL CODE><DELIMITER><CONTROL CODE><TERMINATOR>

Where:

<CONTROL CODE> is actual code i.e. **"R1"**

OR

for codes with value i.e.

<CONTROL CODE> consists of **<CODE>"="<SIGN><VALUE>**

Where:

"=" is not mandatory.

<SIGN> is **"+"** or **<SPACE>** or no character for positive values and **<->** for negative values.

<VALUE> is ASCII numeric value (limits given in code description paragraph 3.2.2).

<DELIMITER> is not mandatory but can be any of the following: "," ";" ":" **<SPACE>**.

<TERMINATOR> is **<CR>**, carriage return.

Example **R1,S0,P=123.45,W20<CR>**

Sets Remote Mode, Units as on F1, Pressure set-point 123.45, Wait time 20secs.

3.2 Shared Control Codes

	Code	Function
	M	Local Control.
Range	R0	Local Control.
	R1	Range (Transducer) 1 & Remote Control.
	R2	Range (Transducer) 2 & Remote Control.
Scale*	S0	Selects units programmed on F1.
	S1	Selects units programmed on F2.
	S2	Selects units programmed on F3.
	S3	Selects units programmed by U command.
Units*	U1 to U21	Programs S3 for 1 of 21 units, see main handbook.
Data Select	D0	Sends current pressure when requested.
	D1	Sends current set-point when requested.
	D2	Sends reading panel value.
Function*	F00	Apply Relay off, schematic indicator "A" off.
	F10	Release Relay off, schematic indicator "R" off.
	F01	Apply Relay on, schematic indicator "A" on.
	F11	Release Relay on, schematic indicator "R" on.
Notation	N0	Return data format, see 4.2.1.
	N1	Return data format, see 4.2.1.
	N2	Return data format, see 4.2.1.
	N3	Return data format, see 4.2.1.
	N4	Return data format, see 4.2.1.
Interrupt	I0	No interrupt, see 4.4.
	I1	Interrupt on "Error".
	I2	Interrupt on "In limit".
	I3	Interrupt on "In limit" and "Error".
	I4	Interrupt on End of Conversion".
	I5	Interrupt on "Error" and "End of Conversion".
	I6	Interrupt on "In limit" and "End of conversion".
	I7	Interrupt on "In limit", "Error" and "End of conversion".

	Code	Function
Controller*	C0 C1	Controller OFF. Controller ON.
Set-point*	P<Value>	Pressure Set-point Value see 3.2.2.
Ratio*	/0 to /11	Select Set-point Ratio as % programmed for keys 0-11 on front panel.
Preset*	*0 to *11	Select Set-point Preset as value programmed for keys 0-11 on front panel.
Wait value	W<Value>	Wait Value = wait time in seconds (100 max) see 3.2.3.
Error	@0 @1	Disable error reporting. Enable error reporting.
Rate*	J0 J1 J2	Selects Rate programmed on F1 see 3.2.4. Selects Rate programmed on F2. Selects Rate programmed on F3.
Zero*	O1	Zero.
Rate Value*	V<Value>	Variable rate value see 3.2.5.

* not available in Local Mode.

3.2.1 Remote/Local Control

The instrument will exit local control and enter remote control after receiving the control code R1 or R2 (Range 1 or Range 2).
The instrument returns to local control after receiving the control code R0 or M.

3.2.2 Set-point Value

The set-point value can be sent as a floating-point number or an integer between -99999 and +99999.

3.2.3 Wait Value (Settling Time)

The settling time value is the approximate time in seconds that the instrument waits, after the pressure and set-point values become equal (within the stated percentage accuracy for instrument full-scale value, see the main instrument data sheet). The "In limit" status sets to "1" when the settling time has elapsed. The settling time value is a positive value between 0 to 100, the default value is 2 seconds.

3.2.4 Rate Setting

The rate is set by the J command. J0 selects the rate programmed on function key F1 on the front panel. J1 selects F2 and J2 selects F3. When requested, the instrument reports the active rate as follows:

J0	=	Variable rate
J1	=	Auto rate
J2	=	Max rate

Example: F1 is set to Max rate. To request F1 setting send J0, the instrument reports J2 (Max rate).

3.2.5 Variable Rate Value

The variable rate value is sent as a floating-point number or an integer between 0 and 99999. The value is units/second. Variable rate mode is entered immediately the value is entered.

3.3 Direct Mode

In the Direct Mode all shared control codes are available. In addition sending <CR> will return the current reading.

3.4 Printer Mode

The Printer Mode allows for the automatic and continuous output of data to a non-programmable device such as a printer.

In the Printer Mode, the output interval is programmed by the main instrument SET-UP menu as printer "N" value. A value of 1 programs the output of data on every new reading, a range of 1 to 9999 is available. A reading number is sent with each output of data.

The output of data takes the following format:

<Reading number>
PRESSURE = <Value><Units>
SET-POINT = <Value><Units>

where: <Reading number> is in the range 1 - 9999999.

3.5 Addressed Mode

3.5.1 Addressed Mode Control Codes

In the Addressed Mode all shared control codes are available. In addition the following features concerned with access to one of several instruments are implemented.

NOTE: All the following codes are blocked by an instrument with "End Device" setting active.

Primary Address

The address range will be 0-99. Each instrument will have a primary address and will be activated to respond to control data if the command string "#L"<address> where <address> is that instrument address. When so activated, the instrument is said to be a LISTENER.

Likewise, an instrument can be activated to send a data packet with its current reading by sending "#T"<address>. When so activated, the instrument is said to be a TALKER.

So that there can only be one TALKER on the ring at a time if a TALKER instrument detects the string "#T"<address> where <address> is not its own address then it will return to a passive state.

Secondary Address

Some Options have Secondary Address capability in line with their IEEE 488 capability. This is a means of communicating with the Option. Such an address is transmitted as a decimal extension to the primary address i.e. "#L"<address>"."<secondary>, where <secondary> is the secondary address.

The following secondary addresses are allocated:

SCM	=	6
Barometric	=	9

Example:

"#T6.6"<CR> Activates secondary address 6 (SCM Option) of primary address 6 as a TALKER, the SCM Option will output a data string.

Universal Commands

The following commands will be acted upon irrespective of the instrument being a TALKER or LISTENER:

#(UNL)	Un-listen will de-activate all Listeners.
#(UNT)	Un-talk will de-activate the current TALKER.
#(IFC)	Interface Clear will reset the communication link, clear all buffers and clear Dialogue mode unless this is established by instrument set-up (see DIA below).

Addressed Commands

The following commands will be acted upon only when the instrument is a LISTENER.

#(DCL) **Device Clear**, establishes a default condition as follows:

(@00)	Error Status cleared.
(NO)	Notation Code.
(DO)	Display Code.
(I0)	Interrupt Code.
(@1)	Error reporting enabled.
(W002)	Wait time.

#(DIA) **Dialogue**, establishes Dialogue Output Format even if instrument has been set-up in non-Dialogue format.

3.5.2 Command Blocking

Shared control codes can be blocked by the end device if a "%" is sent before the control code.

Example: "%R1" <CR>

It is possible to establish any instrument as the **End Device** on the Daisy-chain by the SET-UP procedure. In this mode of operation, the instrument will:

a. NOT allow command packets to pass through (i.e., packets of the form #....<CR>).

b. NOT allow blocked packets to pass through (i.e., packets of the form %....<CR>).

c. NOT allow flow control characters (XON/XOFF) to pass through.

4 OUTPUT CODES

4.1 Output Code Format

The data sent consists of a data string of ASCII characters followed by the terminating characters programmed from the front panel. Data can be in two forms Computer and Dialogue.

The general format is:

<DATA><TERMINATOR>

Where:

<DATA> depends on Notation code/secondary address, see paragraph 4.2.

<TERMINATOR> is one of the following, set from the front panel SET-UP:

<CRLF>
<CR>
<LF>
<SPACE>

Error conditions are indicated by "@" <Value>. The complete parameter is omitted in the absence of error or error reporting is disabled (Control Code @0).

In the Addressed mode the output will be enclosed in "{" and "}". This informs all the other instruments, on the Daisy-Chain, that the string originated from an instrument (not the Control Computer) and is not to be interpreted.

4.2 Computer Format

The format is dependant on the preceding Notation Code or secondary TALK address.

NOTE: The numbers in brackets () are the number of characters per item. Parameters in brackets < > are defined in paragraph 4.2.3.

4.2.1 Notation Codes

Notation Code = N0

Format:
<value(7)><mode(3)><range(2)><scale(2)><value source(2)>
<error code(3)><terminator>

Notation Code = N1

Format:
<value(7)><error code(3)><terminator>

Notation Code = N2

Format:
<mode(3)><range(2)><scale(2)><value source(2)>
<controller status(2)><interrupt code(2)>
<relay status(3)><terminator>

Notation Code = N3

Format:
<In limit status(1)><error code(3)><terminator>

Notation Code = N4

Format:
<error status(2)><terminator code(2)><rate(2)>
<variable rate(8)><units(7)><terminator>

4.2.2 Status Condition

In the Addressed Mode, the low level status condition of the instrument is reported to the control computer when addressed to TALK with the SECONDARY address 15 active.

The status condition of the instrument is displayed as:

<mode(3)><range(2)><scale(2)><value source(2)>
<controller status(2)><interrupt code(2)>
<notation code(2)><wait time(4)><terminator>

In the Addressed Mode, the full status condition of the instrument is reported to the control computer when addressed to TALK with the SECONDARY address 16 active.

The status condition of the instrument is displayed as:

<mode(3)><range(2)><scale(2)><value source(2)>
<controller status(2)><interrupt code(2)><notation code(2)>
<wait time(4)><error status(2)><terminator code(2)><rate(2)>
<variable rate(8)><units(7)><terminator>

4.2.3 Parameter Definitions

Value	=	value selected by the "D" command, signed integer or floating point. When the instrument value is sent, the format is a 6 digit value plus decimal point. The value can be preceded by spaces to complete the 6 digit value. If the value is negative a -ve sign is placed at the front of the value.
Mode	=	REM or LOC, Remote or Local.
Range	=	R1 or R2.
Scale	=	S0 to S3 reports "S" status.
Value Source	=	D0 to D2 reports "D" status.
Terminator	=	<CR><LF><SPACE>
Error Code	=	present if error reporting is enabled and error present ("@" command) see 4.2.4.

Error code is octal representation of a byte where the bits indicate:

Bit 0	Command not accepted.
Bit 1	Option not fitted.
Bit 2	Data string not valid.
Bit 3	Not used (0).
Bit 4	Over range (reading exceeds Transducer range or 99999).
Bit 5-7	Not used (0).

Controller Status	=	C0 or C1, reports "C" status.
Interrupt code	=	I0 to I7 reports "I" status.
Relay Status	=	Value 0-3 is the decimal value of the binary code for the relay status:

F00	A-off, R-off
F01	A-on, R-off
F02	A-off, R-on
F03	A-on, R-on

Notation Code	=	N0 to N4 reports "N" status.
Error Reporting	=	@0 or @1 reports "@" status.
Wait time	=	"W" followed by 3 digit ASCII value, Wait time see paragraph 3.2.3.
Limit Status	=	0 or 1, 0 = out of limit, 1 = in limit.
Terminator Code	=	String Terminator

where:

E0	:	CR, LF
E1	:	CR
E2	:	LF
E3	:	SPACE

Rate	=	Rate mode

where:

J0	:	variable rate
J1	:	auto rate
J2	:	max rate

Variable Rate	=	"V" + variable rate see paragraph 3.2.5.
Units	=	"U" + units in text.

4.2.4 Error Code

In the N0, N1 and N3 Notation Code settings any error occurring, if error reporting is enabled by Control code @1, is indicated by the addition of @ Value at the end of the data string.

The numeric value is a two digit, octal number that allows the representation of the four error functions.

Bit 0	Command not accepted.
Bit 1	Option not fitted.
Bit 2	Data string not valid.
Bit 3	not used (0).
Bit 4	Over-range/over-pressure (reading exceeds 120% of full-scale).
Bit 5-7	not used (0).

For example:

@01	indicates the code sent to the instrument was not executed.
@02	shows an option that is not fitted has been requested.
@04	indicates data string (i.e. reading from instrument) is invalid and must be ignored.
@20	indicates the reading exceeds 120% of full-scale.

"Data string not valid" and " Over-range" error flags are set and only reset when the error has been cleared. "Command not accepted" and "Option not fitted" error flags are cleared each time the option outputs data.

4.3 Dialogue Output Format

When Dialogue Output Format is selected English text replaces the output code for each Notation code.

Received Command = N0

Output is:

PRESSURE/SET-POINT /PANEL	=	<Value(7)> <Units(6)>
MODE	=	REM/LOC
RANGE	=	1/2
ERROR	=	Error report if appropriate

Received Command = N1

Output is:

PRESSURE/SET-POINT /PANEL	=	<Value(7)> <Units(6)>
ERROR	=	Error report if appropriate

Received Command N2

Output is:

CONTROLLER ON/OFF
INTERRUPT ON/OFF/IN LIMIT/ERROR/EOC
A RELAY ON/OFF B RELAY ON/OFF

Received Command = N3

Output is:

OUT OF LIMIT/IN LIMIT
ERROR = Error report if appropriate

Received Command = N4

Output is:

ERROR REPORTING ON/OFF
MAX RATE/AUTO RATE/VAR RATE - ON
RATE = <Value(7)><Units(6)>"/s"
UNITS = Text for units used

Received Command = #T<Address>.15

where <Address> is the address of the instrument.

Output is:

CONTROLLER ON/OFF
INTERRUPT ON/OFF/IN LIMIT/ERROR/EOC
WAIT VALUE = <Wait time(3)>

Received Command = #T<Address>.16

where <Address> is the address of the instrument.

Output is:

ERROR REPORTING ON/OFF
MAX RATE/AUTO RATE/VAR RATE - ON
RATE = <Value(7)><Units(6)>"/s"
UNITS = Text for units used

4.4 Interrupt Data

Interrupt Data is generated spontaneously by the instrument when preset conditions have been achieved in any mode or format.

4.4.1 Interrupt Packet Format "In limit"

When the Interrupt Code is set to I2, I3, I6 or I7 and the "in limit" status changes from 0 to 1 (indicating that the set-point value is within the required limit) the instrument sends a packet in the form:

"!"<address><CR>

where: <address> is the Address of the instrument.

4.4.2 Interrupt Packet Format "In Error"

If an error occurs when the Interrupt Code is set to I1, I3, I5 or I7, the instrument sends a packet in the form:

"!"<address><CR>

where: <address> is the address of the instrument.

4.4.3 Interrupt Packet Format "End of Conversion"

When the Interrupt Code is set to I4, I5, I6 or I7 and an "End of Conversion" occurs, the instrument sends a packet in the form:

"!"<address><CR>

where: <address> is the address of the instrument.

When the Control Computer receives an Interrupt packet it should interrogate the instrument to find out the cause of the Interrupt.