



GE Druck

**Pressure measurement
for research & industry**

Druck Limited
Fir Tree Lane
Groby
Leicester LE6 0FH
England
Tel: 0116 231 7100

Technical Note

DPI 104

Communications protocol

CUSTOMER VERSION

TN0719

© **Druck Limited** 2005

This document is the property of Druck Limited and may not, either in part or whole, be copied or otherwise reproduced, communicated in any way to third parties, nor stored in any data processing system, without the express written authority of Druck Limited.

Amendment Record

| Iss No | Date | C/N No | Originator | Typed | Amendments |
|--------|----------|--------|------------|------------|-------------|
| 1 | 14/10/05 | - | P.A.Weaver | P.A.Weaver | First issue |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Approvals

| | | |
|---------------------------------|---|--|
| Checked (S.Walls) S.T. Walls | Engineering (H. Mankia) H.Mankia QUALITY (K.K.) Rajesh K. K. | |
| | | |

Table of contents

| | | |
|------|---|----|
| 1 | INTRODUCTION | 4 |
| 2 | COMMAND SET | 5 |
| 2.1 | AUTOMATIC DEVICE ADDRESS, AA | 5 |
| 2.2 | READ INPUT CHANNEL READING, IR | 6 |
| 2.3 | SET ENGINEERING UNITS, IU | 7 |
| 2.4 | SET ZERO REFERENCE, IZ | 8 |
| 2.5 | OUTPUT CHANNEL SETPOINT, OP | 8 |
| 2.6 | READ BATTERY VOLTS, RB | 9 |
| 2.7 | READ ERROR STATUS, RE | 9 |
| 2.8 | READ INSTRUMENT TYPE AND VERSION NUMBER, RI | 10 |
| 2.9 | SET INSTRUMENT ADDRESS, SA | 11 |
| 2.10 | ENTER SLEEP MODE, SI | 11 |
| 2.11 | SET FUNCTION REGISTER, SF | 11 |
| 2.12 | READ INSTRUMENT SERIAL NUMBER, SN | 12 |
| | Appendix 1. Example commands and checksums | 13 |

1 INTRODUCTION

This document details the communications protocol used by DPI 104. *This is an abridged list of the commands, and is intended to allow customers to send commands to the DPI104.*

All slave mode communications are at 9600 baud-rate. The DPI104 uses 8 data bits, 1 stop bit with no parity. Each command that does not have an immediate response associated with it (e.g. the "OPI" command) will cause the DPI104 to send an "acknowledge" response consisting of the start character, the two command characters and the terminator characters once the command has been received.

Please note that the complete command must be sent within 300 ms, otherwise the DPI104 will time out and the command will be ignored.

Message frames have the following basic structure:

| Byte Function | Character Sent | Number of Bytes |
|-----------------|---|-----------------|
| Start Character | '*' or '#' or '!' | 1 |
| DD | Destination Address | 2 |
| SS | Source Address | 2 |
| XX | Command. This can be followed by additional data | 2 |
| Separator | : | 1 |
| CS | Checksum | 2 |
| Terminator | <CR><LF> | 2 |

Start Character: The start character '*' causes all command block data to be echoed around the daisy chain. The '#' character will suppress the echoing of block data. The '!' character indicates a response from an instrument.

DD: A 2 digit destination address from 00 - 99

SS: A 2 digit source address from 00 - 99

XX: A 2-character command. This can be followed by additional data as required by the specific command being transmitted.

CS: Checksum is a block checksum and takes the format: NN, Where NN is a 2-digit checksum. This is the modulo 100 sum of all the ASCII codes of the characters in the message string including the start character

An error is reported if an incorrect checksum is received.

Terminator: Is the string termination characters <CR><LF>

For brevity, the start, addressing and termination characters have been removed from the following examples.

In direct mode (using the '#' start character), DDSS will be omitted. So the minimum command will be of the format #XX<CR><LF>, where XX is the command (including checksum and colon separator).

2 COMMAND SET

In normal operational mode, the DPI 104 responds to RS232 commands at 9600 baud. Additionally, it can utilise an external IDOS (UPM) as a pressure sensor (at 19200 baud). However since both use the same communications port, only one connection can be made at a time.

2.1 AUTOMATIC DEVICE ADDRESS, AA

This command can only be used with the # command header block. The effect of this command is to automatically set the addresses of the instruments on the daisy chain to sequentially increasing addresses.

Command: AA

Format: AA=<device address>

Description: Automatic Addressing.

Example: AA=10:<CS>

For, say, 3 instruments on the daisy chain this command will set the instruments to have addresses 10,11, and 12.

First in chain receives command (# means don't echo), it sets its address to 10

First in chain echoes with #AA11 (it increments the passed address), second in chain receives command, and sets its address to 11.

Second in chain echoes with #AA12 (it increments the passed address), third in chain receives command, and sets its address to 12.

The whole process continues, if a device receives #AA98, it does not increment, as only 99 devices are allowable. 99 is the generic code for ALL devices in the chain.

There is no query for this command

2.2 READ INPUT CHANNEL READING, IR

This command allows reading the following channels.

Command: IR

Format: IR[n]? :<CS>
[n] = Channel #

If [n] is omitted, a value of 1 is assumed

Description: Get input channel reading. This is a query only command.

Example:

| | |
|------------|--|
| IR1? :<CS> | Read channel #1 for pressure |
| IR2? :<CS> | Read channel #2 for switch input |
| IR3? :<CS> | Read channel #3 for captured pressure on switch change |
| IR4? :<CS> | Read channel #4 for Peak High pressure reading |
| IR5? :<CS> | Read channel #5 for Peak Low pressure reading |
| IR6? :<CS> | Read channel #6 for voltage output reading |

The DPI 104 replies with:

IR1=<value>:<CS> Value ranges from -9999 to 99999 as shown on the front panel LCD display.

Note: If the measured pressure is out of display range, the DPI 104 will set the "Display Error" flag (please see section 2.7, page 9) when the command is sent.

IR2=<value>:<CS> Switch test returns 0 when contact is open and 1 when the contact is closed.

IR3=<value>:<CS> Value ranges from -9999 to 99999 as displayed on the front panel LCD during a captured pressure reading resulting from a change of state of the test switch.

IR4=<value>:<CS> Value ranges from -9999 to 99999 as shown on the front panel LCD during a PEAK High display.

IR5=<value>:<CS> Value ranges from -9999 to 99999 as shown on the front panel LCD during a PEAK Low display.

IR6=<value>:<CS> Value ranges from 0.000 to 5.000 (V)

Notes:

All pressure values returned are expressed in the currently set engineering units.

2.3 SET ENGINEERING UNITS, IU

This command sets the current pressure units

Command: IU

Format: IU[n]=<index>:<CS>

Description: Set up the units for the specified input channel. The units are specified as <index>, as defined below.

Valid variables are:

[n] = 1 (Input Pressure Channel).

Any other parameter specified will result in a 'Syntax Error' response message.

| | |
|--------------------|---------------|
| mbar | < index> = 00 |
| bar | < index> = 01 |
| kPa | < index> = 04 |
| MPa | < index> = 05 |
| kg/cm ² | < index> = 06 |
| mmHg | < index> = 08 |
| mmH ₂ O | < index> = 11 |
| mH ₂ O | < index> = 13 |
| psi | < index> = 16 |
| inHg | < index> = 18 |
| inH ₂ O | < index> = 19 |

Example:

IU1=16:<CS> Set measured pressure units to psi

2.4 SET ZERO REFERENCE, IZ

Performs a permanent zero offset adjustment.

Command: IZ

Format: IZ=<value>:<CS>

Description: Zero adjust the pressure input channel.

If <value> and '=' are omitted, a value of 0.0 is assumed.
<value> is passed in mbar, and must satisfy the following:

$$\text{value} \leq 5\% \text{ of FS pressure range}$$

Pressure values outside this range will result in a "Zero Error"

Example: IZ:<CS> Zero pressure
IZ=10.0:<CS> Set zero offset value to 10 mbar

The value parameter can be used to adjust the barometric reading of an absolute transducer.

The command also has a query version:

Example: IZ=?:<CS> Query current zero offset
IZ=10.260 mbar:<CS> DPI104 response *in mbar*

2.5 OUTPUT CHANNEL SETPOINT, OP

This command is used to set the voltage output to a set percentage value.

Command: OP

Format: OP=<value>:<CS>

Description: Sets the output channel to <value>

Valid variables are:

<value>= from 0.0 to 100.0 %

Example: OP=50.0: <CS>

Once this command has been issued the following settings will be modified on the DPI 104:

Voltage output mode is changed to user mode
The voltage output scale factor is forced to 1.0

In this manner confusion will be avoided between the previous output mode and the mode set by the command. *This setting only stays valid while the unit is on. If the unit is powered off the setting will revert to the previously saved settings.*

2.6 READ BATTERY VOLTS, RB

This command allows reading the battery/supply voltage measured by the DPI 104. *The value returned is for indication only.*

Command: RB

Format: RB? :<CS>

Description: Read battery voltage. This is a query only command.

Example: RB? :<CS> Queries the battery voltage

The DPI 104 replies with:

RB=<voltage>:<CS>

e.g. RB=9.0:<CS> battery voltage is 9.0V

2.7 READ ERROR STATUS, RE

This command allows reading the last error code issued by the DPI 104. This is a query only command and reports errors that occurred since the last RE? command. After issuing this command, all non-fatal* errors are cleared.

Command: RE

Format: RE? :<CS>

Description: Read Error Code. This is a query only command.

The DPI 104 replies with:

RE=<code>:<CS>

* non-fatal errors are all errors with the exception of the following:
Read/Write error, Gain error, Power up error and Sensor error

<code> is returned in 16 bit ASCII hex format and the bit definitions are as follows:

| | |
|-----------------------|---|
| Syntax error | Set if the command syntax was not understood |
| Parameter error | Set if the parameters in the command were out of range or not valid |
| Configuration error | Factory use only |
| Not Implemented | Not Implemented |
| Checksum error | The received command checksum did not match with the calculated checksum. In this case, the command is not executed and this error bit is set |
| Zero error | An error occurred whilst trying to zero a measurand, probably because the zero offset is too large |
| Calibration error | Factory use only |
| Sequence error | A valid command is received, but cannot be processed because the instrument is not in the appropriate state to execute it. |
| Command not available | The requested function is not available on this instrument |
| Range error | Reading outside range |
| Sensor error | Invalid or no reading from internal pressure sensor |
| Power-up error | Power up self-diagnostic failure |
| Gain error | Factory use only |
| Display error | Unable to display the pressure value due to the units chosen and the display range. |
| Read error | Factory use only |
| Write error | Factory use only |

2.8 READ INSTRUMENT TYPE AND VERSION NUMBER, RI

This command returns the instrument type on the ring including the version of the software code.

Command: RI

Description: Read Device Equipment. This is a query only command.

Example: RI? :<CS> Query Instrument model and version number

The DPI 104 replies with:

RI=DPI104,V1.02.00:<CS>

V1.02.00 indicates software version number.

2.9 SET INSTRUMENT ADDRESS, SA

Read instrument address (for daisy chain mode), only used in direct mode.

Command: SA

Format: SA?:<CS>

Description: read current instrument address

SA?:<CS> Read the instrument address

The reply is of the form:

SA=<nn>:<CS> where <nn> is in the range of 0 – 98.

e.g. SA=10:<CS> current address setting is 10

2.10 ENTER SLEEP MODE, SI

Forces the DPI104 into sleep mode.

Command: SI

Format: SI=inf:<CS>

There is no reply to this command. The DPI104 will wake up on the next DUCI message sent or the next key press. Please note it takes one command to wake the DPI104, but it will not reply to the first command. The unit will respond to the second command sent.

2.11 SET FUNCTION REGISTER, SF

This command is utilized to load function registers within the DPI 104

Command: SF

Format: SF[nn]=<value>:<CS>

Description: Load Function Registers.

Valid variables are:

| <u>[nn]</u> | <u>parameter</u> | <u><value></u> |
|-------------|------------------------|----------------------|
| 0 | Voltage Mode | 0 → 2 |
| 1 | Zero (Tare) function | 0 - 1 |
| 2 | Peak Monitor function | 0 - 1 |
| 3 | Alarm Monitor function | 0 - 1 |

| | | |
|----|-------------------------|--------------------|
| 4 | Auto Off function | 0 - 1 |
| 5 | Menu Lock | 0 - 1 |
| 6 | Switch Mode | 0 - 1 |
| 13 | Voltage Output (%) | 000.0 → 100.0 |
| 14 | Voltage Scale | 0.00 → 9.99 |
| 11 | Scan Rate | 02 → 10 |
| 12 | Menu Lock Code | 000 → 999 |
| 15 | Alarm Low Register (%) | 000.0 → Alarm High |
| 16 | Alarm High Register (%) | Alarm Low → 100.0% |
| 17 | FSO Low Register | Cal Low → FSO High |
| 18 | FSO High Register | FSO Low → Cal High |

Any value out of range or other parameters specified will result in a 'Parameter Error' response message.

Example:

| | |
|-----------------|---|
| SF00=0:<CS> | Output Voltage Mode Disabled |
| SF13=050.0:<CS> | Output Voltage set to 50.0% FSO |
| SF14=1.00:<CS> | Output Voltage Scale Factor set to 1.00 |
| SF11=2:<CS> | Scan Rate set to 2x per second |
| SF12=123:<CS> | Menu Lock code set to 123 |
| SF16=75.0:<CS> | Alarm Register High set to 75.0% FSO |
| SF15=25.0:<CS> | Alarm Register Low set to 25.0% FSO |
| SF[nn]? :<CS> | Queries the status of the register |

The reply is of the form:

SF[nn]=<value>:<CS>

2.12 READ INSTRUMENT SERIAL NUMBER, SN

Read instrument serial number.

Command: SN

Query: SN? Report serial number

The reply is of the form:

SN=<serial number>:<CS>

e.g. SN=123456:<CS> DPI 104 returns serial number as 123456

Appendix 1. Example commands and checksums.

| Command | Command example |
|--|------------------------|
| Read error status | #RE?:07<CR><LF> |
| Set voltage output to a 0% output value (0 V) | #OP=0.0:55<CR><LF> |
| Set voltage output to a 50% output value (2.5 V) | #OP1=50.0:08<CR><LF> |
| Set voltage output to a 75% output value (3.75 V) | #OP1=75.0:15<CR><LF> |
| Set voltage output to a 100% output value (5.0 V) | #OP1=100.0:52<CR><LF> |
| Read battery voltage | #RB?:04<CR><LF> |
| Read pressure | #IR1?:60<CR><LF> |
| Read switch status | #IR2?:61<CR><LF> |
| Read switch pressure | #IR3?:62<CR><LF> |
| Read peak high (max) | #IR4?:63<CR><LF> |
| Read peak low (min) | #IR5?:64<CR><LF> |
| Read Vout | #IR6?:65<CR><LF> |
| Set units to bar | #IU1=01:58<CR><LF> |
| Enter sleep mode | #SI=inf:27<CR><LF> |

Notes:

Commands are not case sensitive, however, please be sure to copy the above commands exactly to ensure that the checksums are correct.