Magnetic precision has a name

Fast Digital Integrator FDI2056

Getting started with the FDI2056

Version 1.0

(Revision 1.1)

May 2014

REVISION HISTORY

v. 1.0 r. 1.0	March 2013	First release
v. 1.0 r. 1.1	May 2014	Fix front page graphics

CONTENTS

GETTING STARTED

1-Introduction

When powered on, the Fast Digital Integrator FDI2056 will check if its working mode is set to native (Ethernet VXI / SCPI compliant) mode or PDI 5025 emulation mode. During the whole start-up operation, the instrument shows “INIT” on its display.

When set in its native mode, the communication to the instrument is established using the Ethernet connector located on the right of the CPU board (the nearest to the extractor).

Once properly started, the instrument will report the current gain on all integration channels.

2-First steps

1) Finding your instrument on the network.

   Once powered, the FDI2056 display will report “INIT” during the whole boot process which can take up to 1 minute. When booted, the FDI2056 will display the current gain on each integration channel.

   During the boot process, the instrument will ignore any commands issued by the host computer.

   The FDI2056 is configured to acquire its IP address using the DHCP protocol.

   The NetBIOS over TCP/IP is activated on the instrument, allowing you to ping it using its hostname to retrieve the IP address attributed during the DHCP process. The hostname of any FDI2056 is constructed as follow: **FDI2056-XXXX**, where the 4-digit **XXXX** number is the second part of the instrument’s serial number. The serial number can be found on the label located on the rear of the instrument (i.e. an instrument having the serial number: S/N 2056-0006 is attributed the hostname **FDI2056-0006**).

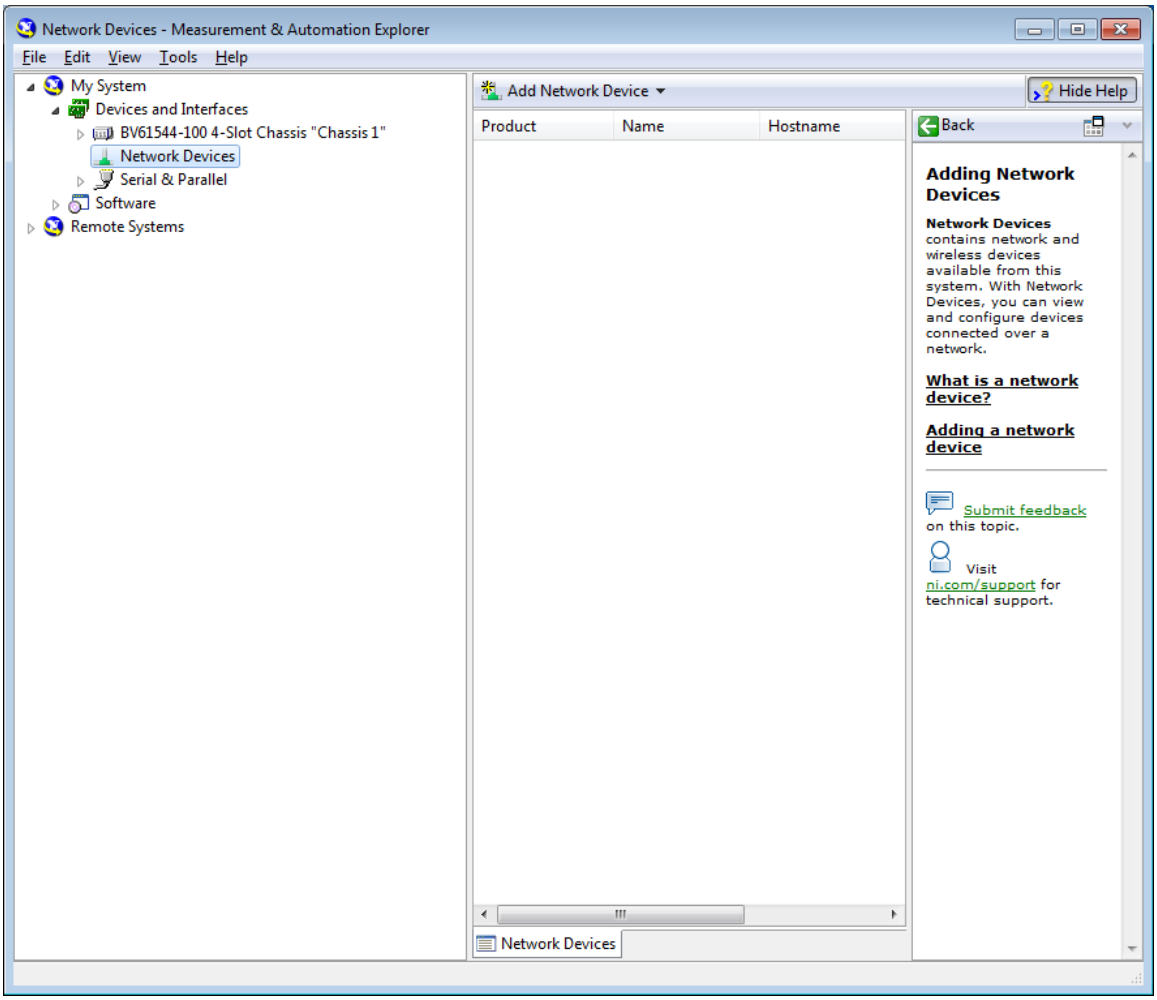
   Please note that the IPv4-link-local protocol is also activated. If your local network fails to provide an IP address using the DHCP protocol, the FDI2056 will be attributed an IP address in the range 169.254.0.0 to 169.254.0.16. As such, using a PC connected directly to the FDI2056 using an Ethernet cable will let you communicate point to point.

2) Install the FDI2056 Remote Manager Software.

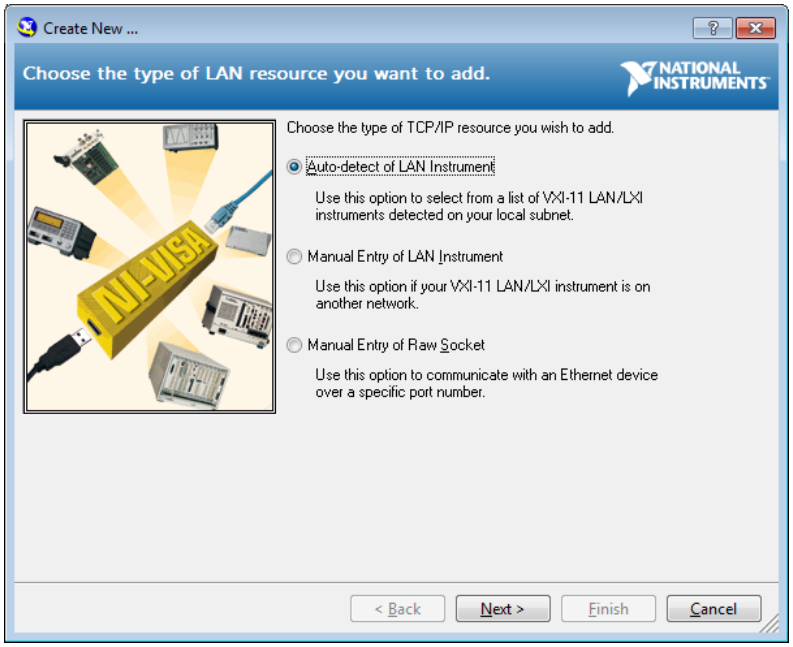
Launch the “setup.exe” application located in the folder “FDI2056 Remote Manager Installer (FULL)\Volume”

3) Setting up the communication.

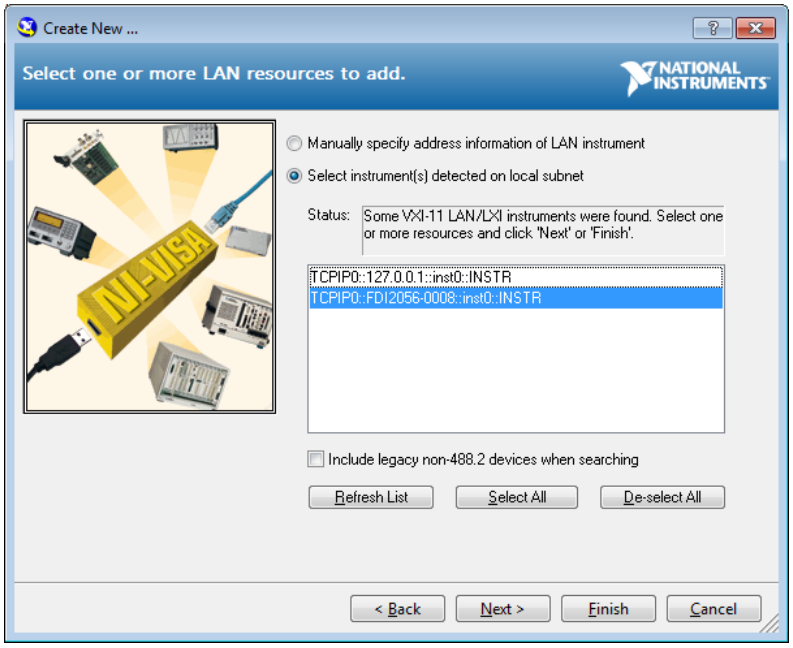
Launch the National Instruments’ NI-MAX software:



Right-Click on the “Network Devices” sub-tree and select the menu “Create New VISA TCP/IP Resource…”. The following dialog box will then appear.



After having pressed the “Next” button, the system will search all VXI-11 compliant instruments over your sub-network. Once this operation is completed, a list of all instruments found on is displayed.



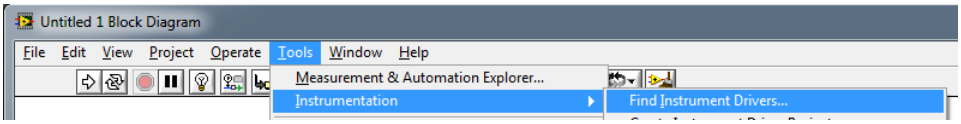
Select the FDI2056 by highlighting it on the list and then press the “Finish” button. You are now ready to communicate with the instrument.

3-Using the instrument

Now that communication is established, you may choose to operate the instrument using the software provided by Metrolab Technology SA, modifying it or by writing your own application software.

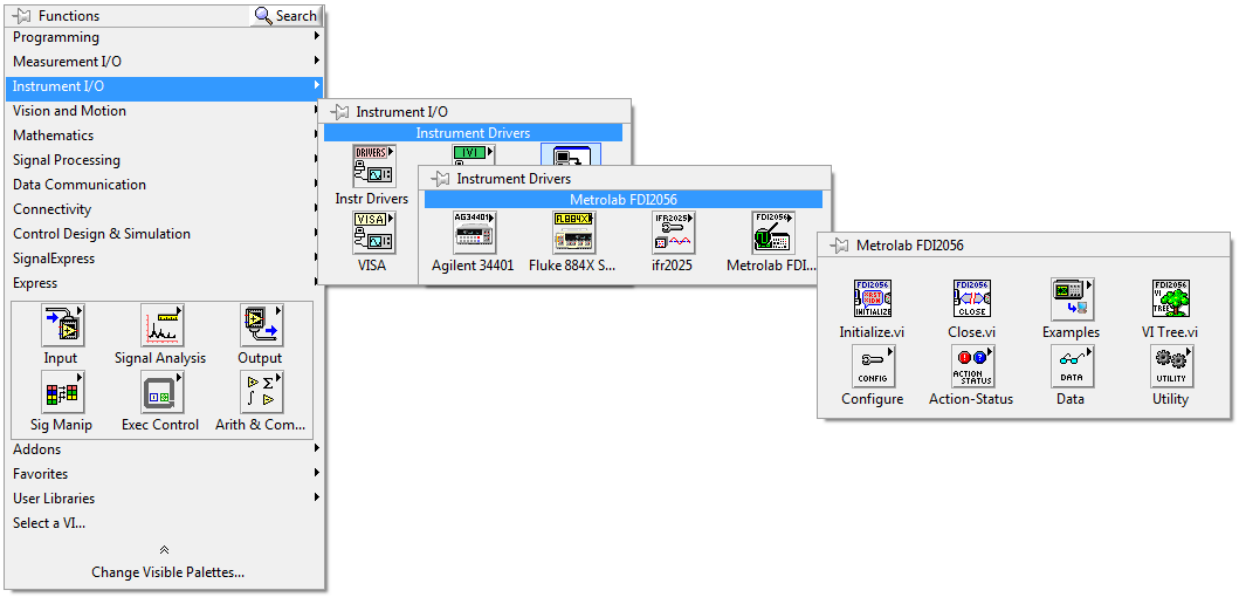
1) Writing your own application using LabVIEW.

   A full driver is provided for LabVIEW. You may freely download it from our website (http://download.metrolab.com/) or by installing the driver directly in LabVIEW (Menu Tools ▸ Instrumentation ▸ Find Instrument Driver).



   At this point, you will have to enter your National Instruments credential – the registration is free - and, after searching for Metrolab Technology in the manufacturer list, you will have to select the instrument model.

   Once this is done, you will be able to download and install the latest instrument driver. When the installation has been completed, you will find the driver API directly in your tool palette, along with all instrument drivers already installed in your system.



   Choosing a VI from the “Example” sub menu is generally a good start. All examples are fully functional and configure some very basic and common measurements.

2) Writing your own application using any other language.

The IVI foundation (http://www.ivifoundation.org/Default.aspx) provides all drivers necessary to write an application using C++, C#, LabWindows/CVI and Matlab. All explanations are available on their web site. If you intend to pursue this path, please do not hesitate to contact us, as we will be happy to provide you with basic starting help. Contact information can be found at the end of this manual.

4-Setting up a rotary encoder

Every FDI 2056 integrator channel is equipped with a micro-D connector. The pins are defined as follow:

Pin n°	Cable color	Function
1	Black	$\overline{B}$
2	Brown	B
3	Red	$\overline{A}$
4	Orange	A
5	Yellow	5 [Volts] or 3.3 [Volts] (Factory default 5 [Volts]) A re-armable fuse safely prevents the system from providing more than 0.750 [Amps].
6	Green	Ground
7	Blue	Error Input
8	Violet	$\overline{\text{Index}}$
9	Grey	Index

The shell is connected to the chassis ground.

When using a single-ended encoder, all signals must be connected to the active high version of the signals (A, B, Index). When using differential signals, you must use the various pairs provided, which are then fed to a differential to single ended driver. The output polarity of the driver follows the polarity of the active high signal (i.e., if A goes high and $\overline{A}$ goes low, the output of the driver will go high).

4-1 VOLTAGE SELECTION

A jumper, located on the daughter board of each of the FDI2056 integrator channels, can be changed to provide either 3.3 Volts or 5 Volts on pin 5 of the

micro-D connector. To change this jumper you must be extremely cautious and proceed following the instruction notice below:

NOTICE

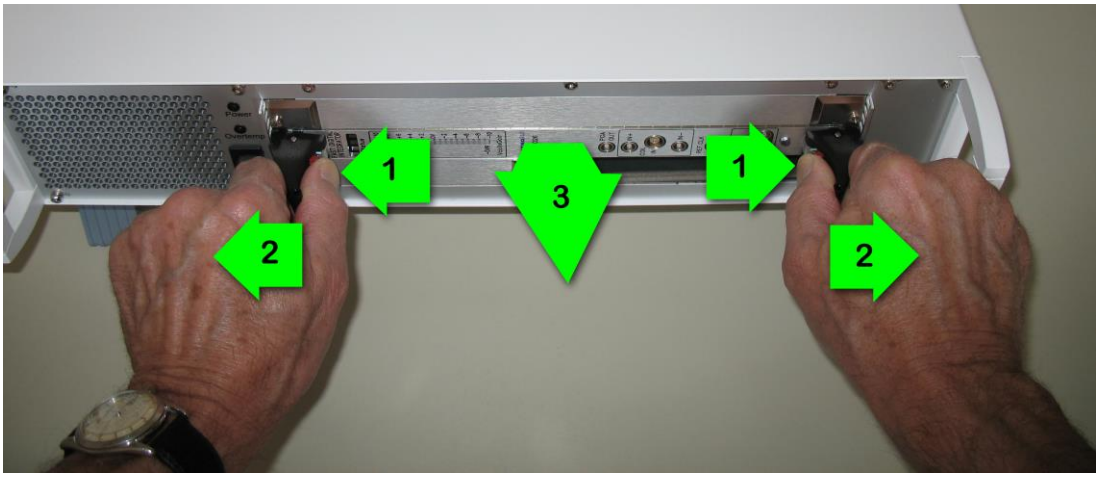
⚠ CAUTION

⇒ Switch the system off.

⇒ Handle the FDI2056 channel card with caution to avoid damage due to electrostatic discharge. Ground yourself before handling the card; the best is to use a grounded wrist-strap during installation.

⇒ To provide additional assurance that the card does not vibrate loose, for example during shipping, the screws behind the extractor lever are tightened. Using a cross-type screwdriver, gently loosen the two screws located on each end of the board.

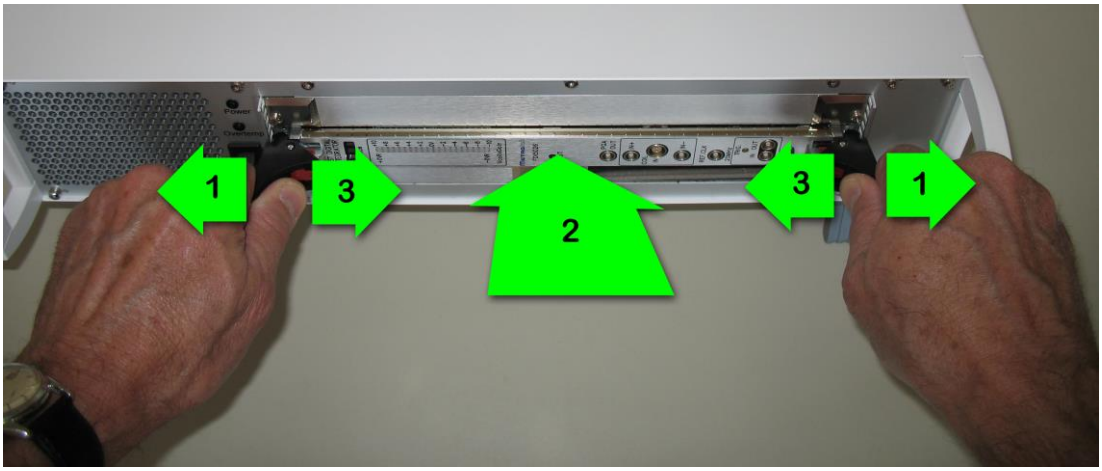
⇒ ① Press the red lock levers with your thumbs; ② Push the black extractor levers outward to extract the card; and ③ Gently pull the card out of the slot. Be careful; see the note in red below.



⇒ WARNING: The FDI2056 channel card has components on the underside that just barely clear the faceplate of adjacent cards. Exercise extreme caution in order not to damage the card when you slide it into the crate. Slide it out slowly, and lift it slightly to keep the components from snagging. On a multiple channels system, proceed by removing the channel which is located the furthest away from the CPU board, i.e., the highest slot number.

⇒ Change the jumper depicted below according to your voltage needs.

⇒ When inserting the card back : ① Push the levers outward; ② Push the card in until the black plastic extractor levers touch the crate; and ③ Push the levers inward until you hear both locks click. On a multiple channels system, proceed by reinserting the channel which is the nearest to the CPU board, i.e. the lowest slot number.



⇒ Tighten the screws behind the extractor lever.

4-2 CONFIGURING THE DECODER

The encoder is believed to provide a minimum of two to a maximum of four signals: a mandatory pair of signals denoted ***A*** and ***B*** which are in quadrature respectively to each other, an optional ***Index*** input and an optional ***Error*** input.

The decoder located on each FDI2056 channel defines the forward direction as the input ***A*** signal in advance in relation to the input ***B*** signal (i.e. the rising edge of signal **A** must precede the rising edge of signal **B**).

The purpose of the ***Index*** signal is to define an absolute mechanical position. This signal is used by the decoder to reset its internal position tracking counter.

If present, the ***Index*** signal must be active high and must have a minimum width of at least 90°. The ***Index***, ***A*** and ***B*** signal must be high at the same time. To prevent any wrong pulse detection, the duration of the ***Index*** signal must not be shorter than the smallest duration of the high state of the composed signal ***A plus B***.

The purpose of the ***Error*** signal is to signify that the encoder is not performing correctly.

If available on your encoder, the ***Error*** signal must be low when no error condition is present.

Knowing this, it is now possible to configure the decoder by adapting the output of your encoder using the command: `CONTRol#:ENCoder:CONFigure.`

4-2-1 CONTRol#:ENCoder:CONFigure

This command accepts as a parameter a quoted string constituted of three fields separated by a comma (,). These fields follow these definitions:

First field : `SINGle|DIFFerential`

Specifies if the encoder provides differential or single-ended signals.

Second field : `A|/A:B|/B[:INDex|/INDex][:ERRor|/ERRor]`

The slash symbol (/) preceding the signal name states that the signal must be negated before use. If either or both of the `INDex` / `ERRor` signals are omitted, the configuration will consider these signals as absent and will behave accordingly.

Third field : `ROTational|LINear:<numerical value>`

Specifies if a `LINear` or a `ROTational` encoder is used. The numerical value specifies the number of lines found on the encoder. The numerical value will be ignored for linear encoders.

Using these definitions, all the following combinations are valid:

`"SING,A:B,ROT:256"`

- Signals are singled ended.
- ***A*** and ***B*** are used directly. No ***Index*** and no ***Error*** signals are provided.
- This is a rotational encoder with 256 lines per turn.

`"DIFF,A:B:/IND,LIN"`

- Signals are differentials.
- ***A*** and ***B*** are used directly, an ***Index*** signal is provided but must be inverted. No ***Error*** signal is provided.
- This is a linear encoder.

`"SING,/A:/B:IND:ERR,ROT:1024"`

- Signals are singled ended.
- ***A*** and ***B*** are inverted before being used. The encoder possesses an ***Index*** and an ***Error*** signal, which are both active high.
- This is a rotational encoder with 1024 lines per turn.

4-2-2 CONTRol#:ENCoder[:POSition]

Setting an absolute position for linear and rotational encoders without index is done by using the command `CONTRol#:ENCoder[:POSition]` followed by a value stating the current encoder position.

Please note that there is no possible way to detect a positional error with such a device as no absolute mechanical position is given. Any pulse loss will inevitably lead to a positional drift.

4-3 MONITORING THE DECODER

Once configured, it is possible to monitor the behavior of the decoder. For that purpose, five (5) commands are available and are described below.

4-3-1 STATus:QUEStionable:INSTrument:ISUMmary#:CONDition?

This command reports whether part of the instrument is questionable or not. One register exists for each channel. The value returned is a set which specifies which part of the instrument's channel is questionable. The specific bit monitoring the decoder is the bit 11.

This register is automatically cleared after reading.

Bit number	Channel questionable part	
0	Voltage:	An over-range condition occurred during the last measurement.
8	Calibration:	The calibration date is overdue. This is a warning only, as the calibration interval is based on a recommendation only. It is up to the user to decide whether the instrument must be recalibrated or not, following the user's internal company procedures.
9	Trigger:	More than one trigger event was detected between two

Bit number	Channel questionable part	
		data acquisitions.
10	Integration:	The internal integration accumulator over-ranged.
11	*Encoder:*	*The decoder seems to have missed a pulse or is in error.*

4-3-2 STATus:QUEStionable:ENCoder:CONDition?

This command reports only if an encoder error is present. The value returned is a composition of all error condition on every channel, starting bit 1, for channel number 1, and going up to bit 9, for channel number 9. Each channel in error will result in its corresponding bit being set to one (i.e. an error on channel 1 and 2 will result in the command returning: $2^1 + 2^2 = 6$).

This register is automatically cleared after reading.

Bit number	Questionable Channel
0	Unused, always 0.
1	*When set to 1, channel 1 is questionable.*
2..13	*Ditto, respectively for each channel numbered 2 to 13.*
14	*When set to 1, channel 14 is questionable.*
15	Unused, always 0.

4-3-3 STATus:OPERation:INSTrument:ISUMmary#:CONDition?

One register exists for each channel. The value returned is a set which specifies which part of the instrument's channel is operating. Bit numbered 10 of this register monitors the ***Index*** signal activity.

This register is automatically cleared after reading.

Bit number	Channel current operation or reported condition
4	Measuring.
5	Waiting for trigger.
6	Waiting for arm.
7	Correcting.
8	A parameter of the channel has just changed.
9	Data are available and might be fetched.

Bit number	Channel current operation or reported condition
10	*The index signal has been detected.*

4-3-4 STATus:OPERation:ENCoder:CONDition?

This command reports only if an encoder index condition has been detected. The value returned is a composition of index detection on every channel, starting from bit 1, for channel number 1, and going up to bit 9, for channel number 9. Each channel in error will result in its corresponding bit being set to one (i.e. an index found on channel 9 will result in the command returning: $2^9 = 512$).

This register is automatically cleared after reading.

Bit number	Index found on channel
0	Unused, always 0.
1	*When set to 1, index was found on channel 1.*
2..13	*Ditto, respectively for each channel numbered 2 to 13.*
14	*When set to 1, index was found on channel 14.*
15	Unused, always 0.

4-3-5 CONTRol#:ENCoder[:POSition]?

The command returns the current position of the encoder.

5-Contact Information

If you encounter any difficulties in configuring or using the FDI2056, please do not hesitate to contact us by email at info@metrolab.com