ITA NODE TYPE 1
Operating Manual

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CHAPTER 1 – Functional Description

1.1 Introduction

The ITA Type 1 Node provides 16 channels of analog input together with all signal conditioning and analog-to-digital conversion to interface 16 two-wire ICP type transducers (eg. accelerometers), or 16 voltage inputs, to an ethernet network.

The node responds to all relevant network data exchanges as defined by the ICONET and ethernet protocol using the UDP/IP standard. In addition, a comprehensive on-board monitor program is incorporated which, optionally, enables all functions to be exercised via the on-board serial RS232 port.

1.2 Ethernet Address

Every ITA node has a unique IEEE assigned MAC address and this is shown on the label attached to the ITA board. *This MAC address should not be modified*.

Prior to installation, the only set-up required is to assign an IP address to the node. This must be a unique address on the network. The address is assigned by connecting a terminal (or PC in terminal mode) to the serial RS232 port and using the on-board monitor program.

The address is held in non-volatile flash memory and will remain until overwritten.

1.3 Mechanical

The Type 1 Node comprises a single electronic circuit board housed in a sealed enclosure. Connections from cables to the main circuit board are via plug-in connectors using screw terminals. No soldering or crimping is required.

1.4 Electrical

The circuit board is a completely self-contained 16-channel analog input to ethernet interface, including power regulation and local communications facilities. A block diagram of the board is shown in figure 1. Each block is described below.

- ICP Interface: each of the 16 channels has its own ICP interface which is capable of powering a typical two-wire transducer. The nominal voltage is 24V with a constant current of 3.6mA. A typical transducer will have a quiescent voltage of around 11V, so that the Type 1 Node can accommodate a full +/- 10V input range. The ICP interface can be disabled for AC and DC coupling of voltage signals. The node incorporates the facility for checking of the transducer quiescent voltage to identify faulty transducers or transducer cabling.

- Multiplexer: the multiplexer circuit selects one of the 16 channels under software control. All inputs are over-voltage and ESD protected.

- HP Filters: four programmable high-pass filters are available to remove unwanted low frequency signals.

- Integrator: an on-board hardware integrator is available for producing a velocity signature from an accelerometer.

- Bearing Demodulation Function: this provides a conditioned signal suitable for the measurement of bearing condition.

- Anti-Aliasing Filter: this filter removes high-frequency components from the incoming analog signal which might alias back into the sampled signal and result in incorrect data in a spectrum. The filter has a very high roll-off and will remove alias effects in standard sampling/spectral analysis applications. The anti-alias filter can be bypassed if desired.

- Analog-to-Digital Converter (ADC): the ADC samples up to 51.2kHz and has 16-bit resolution (ie a theoretical dynamic range of 96dB).

- Clock Generator: the timer varies the sampling rate under microprocessor control. If desired, sampling can be synchronised to one of 4 external triggers (typically a once-per-rev signal from a rotating shaft). A pre-programmed number of samples per revolution can be achieved using this system. The external triggers also act as tachometer functions to determine shaft speed. Pre and post-trigger functions are available. The sampling system can also act in phase-lock-loop mode to synchronise sampling to machine speed.

- Triggers: four trigger inputs are available. These can be set as isolated or non-isolated. Two of the triggers can be used as event inputs, for example, to initiate a reading sequence on an external occurrence. Two triggers can also be used as gate inputs to enable and disable data acquisition dependent on external machine/controller status. The Sync Drive is an output which can drive the event inputs of the ITA's to synchronise data record sampling. One ITA acts as a master and the other as slaves.

- Programmable Gain Amplifier (PGA): the PGA can select gains under software control in steps of 1, 5, 10, 50, 100, 500, 1000. It can also act in auto-range mode to automatically set the input gain as each channel is selected. This maximises the signal range as seen by the 16-bit analog-to-digital converter.

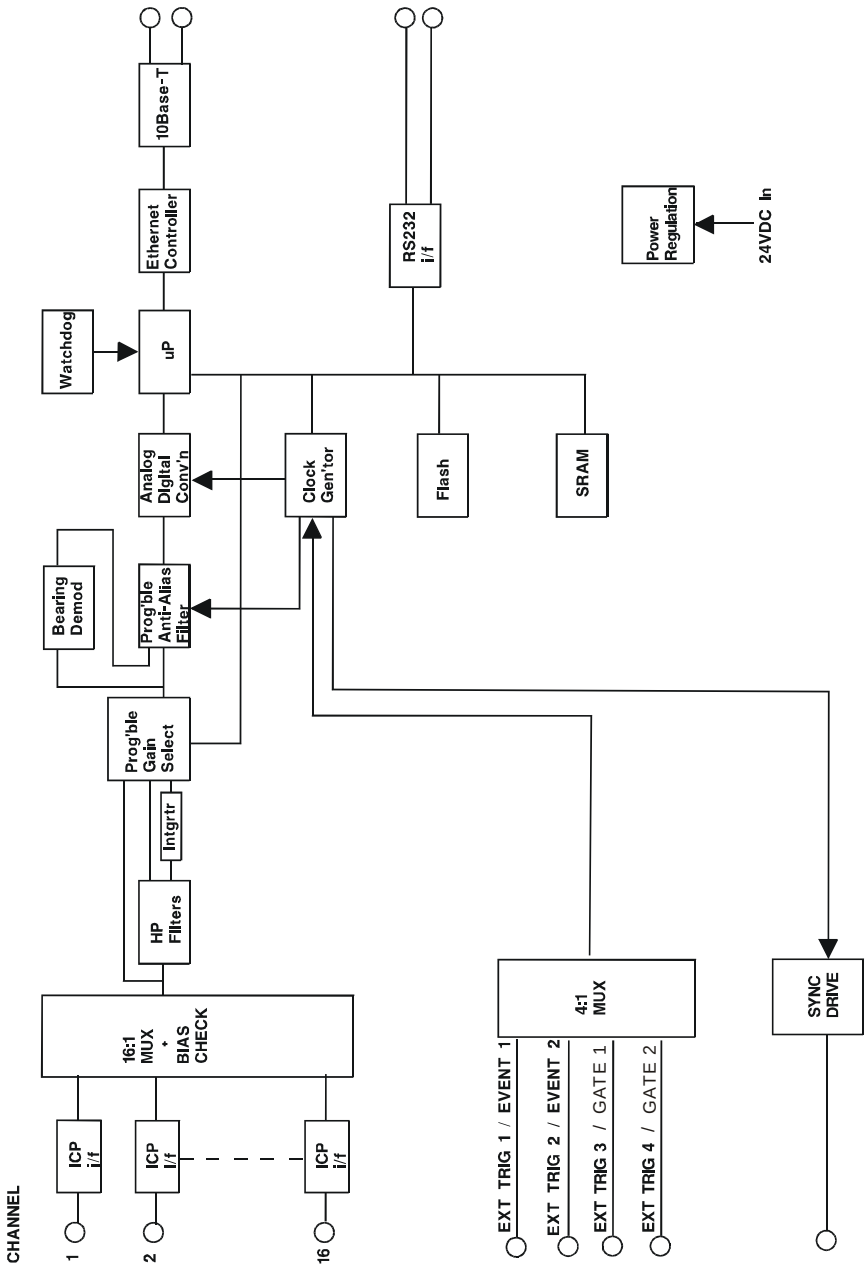
- Microprocessor Subsystem: this comprises the microprocessor, flash memory, and SRAM memory. The microprocessor controls the node under instructions stored in the flash memory. The SRAM memory acts as a temporary data storage area if buffering is required before data is transferred over the network.

- Watchdog: the microprocessor subsystem incorporates a watchdog facility such that, if the ITA node is interrupted by a power glitch or other external effect, it will automatically reset without the need for user intervention.

- Ethernet Controller/Buffer Memory/10Base-T: these functions control data transfer over the ethernet network. The system uses the UDP/IP standard protocol and implements 10Base-T as the physical network layer.

- Power Regulation: the nominal supply voltage to the node card is 24Vdc, but any voltage in the range 20-30Vdc is acceptable. The ITA-1/PS unit is fitted with a mains power supply that provides the 24Vdc power requirement. The input range of the mains power supply is 100-240Vac.

Figure 1
Type 1 ITA Node Block Diagram



CHAPTER 2 – Electrical Connections

2.1 Connectors

The type 1 Node has ten connectors. The function of each connector is as follows:

Connector	No of Pins	Function
J1	16	Analog Input Channels 1-8
J2	16	Analog Input Channels 9-16
J3	3	External trigger 1 / Event 1
J4	3	External Trigger 2 / Event 2
J5	3	External Trigger 3 / Gate 3
J6	3	External Trigger 4 / Gate 4
J7	-	Not Fitted
J8	RJ45	Ethernet Interface
J9	2	Supply Voltage
J10	-	Not Fitted
J11	DB9	Serial Port (RS232)
J12	2	Event Sync Output

The location of the connectors is shown in figure 2, together with the position of pin 1 on each connector. Connector pin-outs are as shown below:

J1: Analog Inputs 1-8

Signal	Pin No.
CH1 input	1
CH1 ground	2
CH2 input	3
CH2 ground	4
CH3 input	5
CH3 ground	6
CH4 input	7
CH4 ground	8
CH5 input	9
CH5 ground	10
CH6 input	11
CH6 ground	12
CH7 input	13
CH7 ground	14
CH8 input	15
CH8 ground	16

J2: Analog Inputs 9-16

Signal	Pin No.
CH9 input	1
CH9 ground	2
CH10 input	3
CH10 ground	4
CH11 input	5
CH11 ground	6
CH12 input	7
CH12 ground	8
CH13 input	9
CH13 ground	10
CH14 input	11
CH14 ground	12
CH15 input	13
CH15 ground	14
CH16 input	15
CH16 ground	16

J3: External Trigger / Event 1

Signal	Pin No.
Power Supply	1
Input	2
Ground	3

See note 2.1
See note 2.2

J4: External Trigger 2 / Event 2

Signal	Pin No.
Power Supply	1
Input	2
Ground	3

See note 2.1
See note 2.2

J5: External Trigger 3 / Gate 3

Signal	Pin No.
Power Supply	1
Input	2
Ground	3

See note 2.1
See note 2.2

J6: External Trigger 4 / Gate 4

Signal	Pin No.
Power Supply	1
Input	2
Ground	3

See note 2.1
See note 2.2

J8: Ethernet Interface

Signal	Pin No.
1	TXD
2	TXN
3	RXP
6	RXN

J9: Supply Voltage

Signal	Pin No.
Positive Supply Voltage	+
Common	-

See note 2.3

J10: Not User Accessible

J11: Serial Port (RS232)

Signal	Pin No.
RXD	2
TXD	3
Ground	5

J12: Event Sync Output

Signal	Pin No.
Sync Out	1
Ground	2

See note 2.4

Notes:

2.1. A supply voltage is available on pin 1 of the connector to power an external trigger device. The voltage is equal to the voltage of the incoming power supply on the board (on connector J9).

2.2. The external trigger is compatible with any voltage input in the range 5-24Vdc. The trigger can be isolated or non-isolated.

2.3. Rated supply voltage is 24Vdc, but any voltage in the range 20-30Vdc is acceptable. Approximate current consumption is 100mA, with no transducers connected.

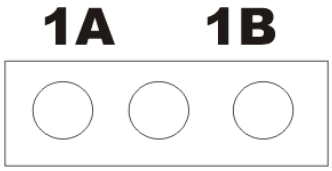
2.4. The Sync Out signal is a high-side switch directly from the input power supply to the board (ie. The same voltage as the power supply). It therefore fundamentally provides a current drive to Event inputs, making the synchro master/slave trigger system immune from external voltage spikes. There is a 100 ohm current limiting resistor fitted to this output.

2.2 Analog Input Configuration

The 16 analog inputs can be set in three different coupling configurations. This is done by setting a jumper on the 3-way pin header on each channel. The three possible configurations are:

- ICP interface (nominal 24V supply at 3.6mA constant current for transducer powering)
- DC Coupled
- AC Coupled

Each channel has a 3-way header associated with it. These are labelled with the channel number ‘A’ or ‘B’ for the jumper position. The three jumper options are: fitted to position A, fitted to position B, or not fitted. A typical jumper layout (Channel 1 in this example) is shown below



Coupling settings are according to the following table:

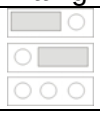
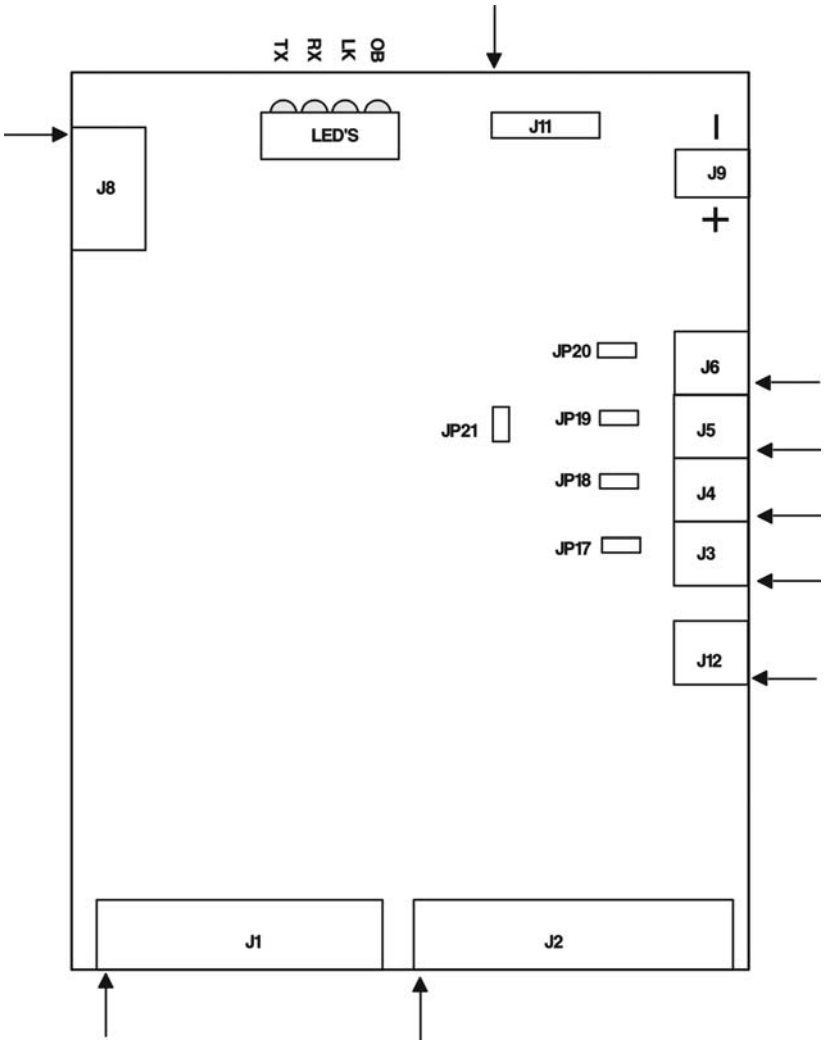
Coupling	Jumper Position	Fitting
ICP Interface	A	
DC Coupled	B	
AC Coupled	Not Fitted	

Figure 2
ITA Node Connector Locations



Arrow marks pin 1 position.

2.3 LED's

Four LED's as shown in figrure 2, indicate the status of ethernet communication. These illuminate as follows:

OB: ITA is accessing LAN controller on the board
LK: communication link is established between ITA node and network
RX: data is being received
TX: data is being transmitted

2.4 Trigger Isolation Jumpers

Four jumpers, JP17 to JP20, are sited on the board to enable the four trigger inputs to be isolated or non-isolated (ie. the common of the trigger input can be connected to the common of the ITA node). With a jumper removed, the trigger is isolated. The table below summarises the jumper positions.

Mode	Jumper
Ext Trig 1 Isolated	JP17 OUT
Ext Trig 1 Non-Isolated	JP17 IN
Ext Trig 2 Isolated	JP18 OUT
Ext Trig 2 Non-Isolated	JP18 IN
Ext Trig 3 Isolated	JP19 OUT
Ext Trig 3 Non-Isolated	JP19 IN
Ext Trig 4 Isolated	JP20 OUT
Ext Trig 4 Non-Isolated	JP20 IN

If an external sensor is to be used which is powered from pin 1 of J3, J4, J5 or J6, then the jumper corresponding to the trigger channel must be inserted to provide a ground return path for the sensor power.

2.5 Monitor Mode Jumper

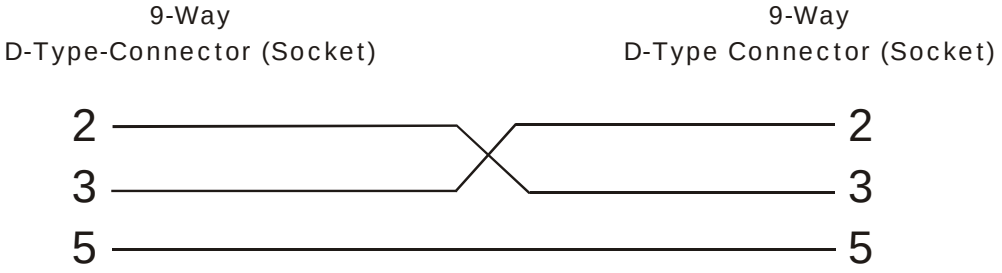
The ITA node incorporates an on-board monitor program for checking the unit and modifying the node's IP address. The monitor is entered by inserting a jumper in JP21.

Mode	JP21
Normal	OUT
Monitor	IN

2.6 Serial Port (RS232)

An RS232 compatible serial port is available on connector J11 providing local communication with the board (ie. independent of the network). Only RXD and TXD lines are supported. An on-board software monitor is provided which communicates via the serial port. Refer to the relevant chapter for details on its operation.

Recommended cable for connection to a PC is an industry standard PC AT-AT DB9 cable, or a cable as show below:



Note that handshaking is not used when communicating with the ITA-1. Therefore, when using a utility such as Windows **HyperTerminal**, the **Flow Contro**l option must be set to **None**.

2.7 Supply Voltage

The input supply voltage on connector J9 is rated at 24Vdc, but any input voltage in the range 20-30Vdc is acceptable. Approximate power consumption is 100mA with no ICP transducers connected, or 160mA with 16 transducers supplied from the board.

CHAPTER 3 – On Board Monitor

When a jumper is inserted into JP21, the node will operate in its internal monitor mode. This enables all the node functions to be interrogated and exercised. In addition, the node IP address can be assigned using the monitor.

To invoke monitor mode, a terminal (or PC computer in HyperTerminal mode) should be connected to the serial port and a jumper positioned in JP21. Power should be removed and reconnected to reset the node. A sign-on message will appear on the terminal together with a list of options to set up and run various functions.

The function menu list is self-explanatory. When a function is selected, an option list is shown and the appropriate selection can be made by typing the relevant key on the keyboard. Pressing ESCAPE returns to the function menu list.

Monitor mode is useful during system installation and to help debugging if a fault is suspected.

To exit monitor mode, simply remove the jumper and briefly remove power to reset the node.

CHAPTER 4 – Installation Instructions

4.1 Installation Instructions

For the safety of the installer and subsequent service personnel, it is important that this section of the manual is read prior to installation.

4.1. Safety

To comply with safety directives, the installer must adhere to the following safety requirements.

1. The unit must be connected to the mains supply via a single spur which has a switch or circuit breaker installed to isolate the unit when required. The switch or breaker should be properly labelled to identify the unit to which it is connected. Conductor size of mains cable must be 0.75mm² per conductor.

2. The unit must have a safety earth connection using wire rated at 25A minimum. This should be connected to one of the earth tags (marked with green earth symbol).

3. The line connection should be fitted with a 3A fuse rated 250V.

4. Refer to the rating label on the unit for mains voltage and frequency input range.

5. The mains supply must be connected as follows:

   - live (brown wire) to terminal L
   - neutral (blue wire) to terminal N
   - earth (green/yellow wire) to earth terminal

6. Live terminals are fitted with a protective cover. This should always be replaced after service operations.

7. Do not tamper with or deface safety or rating labels. They are there to ensure safe operation and servicing.

4.2. Power Supply

The internal power supply is fitted with a 2A fuse. To replace this, remove the power supply cover and exchange the fuse in the fuseholder with a 2A (5x20mm) fuse, type 250V T2A (IEC type) or 250V, 2A (UL/CSA) type.

4.3. Screening

For optimum performance, screened cables should be used for all connections to the ITA enclosure.

For transducers, the screens on the cables should be connected to chassis ground at one point only. This could be where the transducer is situated, in an intermediate

junction box, or the ITA enclosure itself. Chassis earth terminals are provided in the ITA for this purpose.

Chassis ground and the common of the ITA circuitry are connected together inside the ITA enclosure. It is therefore important that chassis ground (ie. screening) and common ground (eg. common wires to transducers) are not connected together elsewhere.

The mains cable should also be screened.

4.4. Mains Connection

As stated in the section on safety, a 3A fuse and isolating switch should be fitted to the mains supply to the unit. Only one fuse should be fitted to the live line – no fuse should be fitted in the neutral line.

Live (L) and neutral (N) terminals are labelled in the enclosure, and the earth terminal is green/yellow. A separate safety earth should be connected to one of the earth tags.

4.5. Mechanical

The ITA unit is supplied with a set of wall mounting brackets. The enclosure can be mounted using the four holes in the back of the unit, or using the bracket kit.

To enable easy drilling and mounting of the enclosure, the mounting plate on which all electrical items are fitted can be removed. The screws at each of the four corners of the mounting plate can be removed for this purpose.

Rubber bungs are supplied to seal any unused mounting holes.

TECHNICAL SPECIFICATION

Analog Inputs

No. of Channels	:	16
Ranges	:	±10mV to ±10V, 7 ranges (programmable)
ICP Interfaces	:	3.6mA @ 24Vdc, configurable per channel
Other Coupling	:	AC or DC, configurable per channel (with optional DC offset removal)
Voltage Protection	:	Protects against overvoltage and up to 2000V ESD protection
Transducer Bias Check	:	Direct reading of ICP transducer bias voltage
Anti-Alias Filter	:	Compound analog filter with roll-off better than 20^{th} order filter with cut-off frequency related to sample rate
High Pass Filters	:	Programmable 4^{th} order with corner frequencies 0.5, 2, 10 and 100Hz
Channel Crosstalk	:	-75dB (typ.)
Amplitude Accuracy	:	±2% typical in passband
Harmonic Distortion	:	-75dB (typ.)
Integration	:	One level of hardware integration, stopband edge at 0.5Hz
Acquisition Modes	:	Mode 1: Timed pickup Mode 2: Data Ready flag Mode 3: Data broadcast
Demodulation Function	:	8^{th} Order bandpass filter + enveloper + averager (filter settable – factory default 600Hz to 2kHz)

Triggers

No. of channels	:	4
Coupling	:	5-24Vdc, isolated or non-isolated
Tacho Speed Range	:	0.01Hz to 10kHz using once-per-rev input (divide-by-N up to 255 available)
Order Analysis	:	Phase-lock-loop for order analysis function
Averaging	:	1,2,4,…32768 programmable
Trigger Delays	:	Pre-trigger delay up to 16384 samples and post-trigger delay up to 32768 samples
Event Trigger	:	2 trigger inputs can be used as event inputs to synchronisation sampling
Gated Acquisition	:	2 trigger inputs can be used to enable and disable sampling
Event Sync Out	:	1 high-drive synchronising output to drive event inputs on other ITA's

Processing

ADC	:	16 bit
Sampling Rate	:	64Hz to 51.2kHz
Effective Frequency Bandwidth Ranges	:	0.15Hz-2.5Hz to 0.15Hz-20kHz
Dynamic Range	:	96dB (theoretical)
Block Range	:	256, 512, 1024, 2048, 8192, 16384 or 32768 (max length 16384 with pre-trigger)
Watchdog Function	:	Automatic recovery on power interruption or similar

Outputs

Status	:	4 LED's indicate system communication status
Interface port	:	RS232, 9600 baud for diagnostics

Storage

Memory Buffer	:	0.6Mbyte free space

Mechanical

Protection	:	NEMA 4X, IP66
Enclosure	:	Powder coated mild steel standard, stainless steel optional

Environmental

Temperature	:	-10° to 60°C

Power

Power Supply	:	24Vdc nominal (20-30Vdc acceptable), or optional 100-240Vac power supply (ITA-1/PS version)
Power Consumption	:	100mA approx. plus 3.6mA per transducer from 24Vdc

Communications

Network	:	Ethernet
Medium	:	10Base-T
Cable	:	CAT5 recommended
Connectors	:	Weidmuller Klippon terminal connectors
Speed	:	10Mbits/sec
Isolation	:	1000Vms

Specification is subject to change without notice.