iT150 Series
Vibration Transmitters
Installation and Operating Manual

Please read this manual thoroughly before making electrical connections and applying power to the module. Following the instructions in this manual will ensure the transmitter delivers optimum performance.

Make sure you always use the latest product documentation. The latest manuals and technical information can be found at www.wilcoxon.com.

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1 Introduction

This document contains information on the installation and operation of the iT150 Series of Vibration Transmitters. The transmitters are designed and manufactured in the USA by Wilcoxon Sensing Technologies, Frederick, Maryland.

2 Description

The iT150 vibration transmitter performs acquisition and processing of dynamic vibration signals. The transmitter accepts vibration signals from piezoelectric (IEPE-type) accelerometers, piezovelocity transducers (PVT™) and other sensors with comparable electrical characteristics. The iT150 also features an input for connection to a Model 786T-type (or compatible) temperature sensor.

The transmitter conditions, digitizes and processes the input signal using powerful DSP technology. All filtering, frequency selection, sub-sampling and power detection is performed digitally, for consistent, reliable results. The vibration measurement result is then scaled and converted to a 4-20 mA analog output. A temperature measurement result is also available as a separate current loop output.

The transmitters are factory-configured, allowing for quick and easy field deployment. There are no hardware jumpers or switches to set. User-specified parameters include: input signal type, detector type, output type, English or metric units, 4-20 mA full-scale range and measurement bandwidth.

The iT150 is housed in a durable plastic enclosure with a 35 mm DIN rail mount. A convenient, front-panel BNC connector allows monitoring of the buffered sensor output. LEDs provide at-a-glance operational status and indicate when power, sensor and 4-20 mA loops are correctly connected to the transmitter and working properly. Removable, uniquely-keyed terminal blocks allow for easy wiring and ensure correct terminal block installation into the various module IO ports.

3 Key features

- Nine frequency band options
  - 0.2 - 200 Hz
  - 0.5 - 500 Hz
  - 1 - 1,000 Hz
  - 10 - 1,000 Hz
  - 2 - 2,000 Hz
  - 5 - 5,000 Hz
  - 10 - 10,000 Hz
  - 20 - 20,000 Hz
  - 10 - 25,000 Hz (true peak only)
- Four detector options
  - True RMS
  - Equivalent peak
  - Equivalent peak-to-peak
  - True peak
- Temperature sensor input
- Dual, 4-20 mA active current loop outputs
- Optional integrated output, based on sensor type
  - acceleration-to-velocity
  - velocity-to-displacement
- English or metric measurement units
- 20 V p-p sensor input range, >90 dB dynamic range
- Digital signal processing
- Built-in constant current source for IEPE sensors
- Buffered sensor output on front-panel BNC connector
- Buffered sensor and temperature outputs on screw terminals
- 3-way isolated (500 VAC) IO ports to prevent ground loops
- Wide, 11-32 VDC power supply input with reverse polarity and transient protection
- TBUS powering (iT3xx compatible)
- ESD and short circuit protection on all ports
- Pluggable, individually-keyed terminal blocks with screw terminals on all ports
- Front panel LED status indicators
- 35 mm DIN rail mounting, stackable on TBUS
- 4-terminal wide (22.5 mm) modular housing
- Wide operating temperature range of -40°C to +70°C
- CE approvals, RoHS compliant

4 Abbreviations used in this manual

A	Amps
BOV	Bias Output Voltage
DCS	Distributed Control System
DIN	Deutsches Institut für Normung
DSP	Digital Signal Processor/Processing
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
FFT	Fast Fourier Transform
IEEE	Institute of Electrical and Electronics Engineers
IEPE	Integrated Electronics Piezo Electric
IO	Input-Output
IP	Ingress Protection
IPS	Inches Per Second
LED	Light Emitting Diode
mA	milliamps
MCU	MicroController Unit
mm	millimeters
ms	milliseconds
mV	millivolts
PLC	Programmable Logic Controller
PELV	Protected Extra-Low Voltage
RMS	Root Mean Square
RoHS	Restriction of Hazardous Substances Directive
SELV	Safety Extra-Low Voltage

5 Safety Regulations and Installation Notes

WARNING: This symbol indicates a caution or warning that, if ignored, could cause damage to the product or connected equipment.

This symbol indicates a technical tip or advice on operation that provides helpful information on how to use or configure the module.

WARNING: Risk of electric shock

- During operation, certain parts of this device may carry hazardous voltages. Disregarding this warning may result in damage to equipment and/or serious personal injury.
- Provide a switch/circuit breaker close to the device, which is labeled as the disconnect device for this device or the entire control cabinet.
- Provide overcurrent protection ($I \leq 6$ A) in the installation.
- Disconnect the device from all power sources during maintenance work and configuration (the device can remain connected to SELV or PELV circuits).

5.1 Safety summary

Because this product is designed to be used in an industrial environment, personnel involved with the installation, operation and maintenance of this instrument should be familiar with all plant safety requirements before using this product. Only qualified personnel should perform installation and service.

The transmitter must not be opened. There are no user serviceable parts within the product. Do not attempt to repair or modify the module. Replace the module only with an equivalent device.

The IP20 ingress protection rating (IEC 60529/EN 60529) implies the module is intended for installation and use only in a clean and dry environment. The module must not be subjected to stresses or thermal conditions which exceed the specified limits.

The device is not designed for use in atmospheres with a danger of dust explosions. If dust is present, the module must be installed within an approved housing, whereby the surface temperature of the housing must be taken into consideration.

Use common sense and avoid haste during installation and operation of this product.

5.2 Declaration of conformity

This product complies with the standards for:

- Electrical safety according to EN61010-1
- Limits and methods of measurement of radio disturbance characteristics
- Limits for harmonic current emissions
- RoHS Directive, 2011/65/EU

6 Ordering information

6.1 Part number decoder

iT150	A	100	RMS	A	g	1	10	10000

Input type	
A	Acceleration
V	Velocity

Sensitivity	
10	mV/g, mV/ips
100	
500	

Detector type	
RMS	True RMS
P	Peak (equiv.)
PP	Peak-to-peak (equiv.)
TP Note 1	True peak (10-25000 Hz)

Output type	
A	Acceleration
V	Velocity
D Note 2	Displacement

Units	
g	g
ips	ips
mils Note 2	mils
m/s/s	m/s^2
mm/s	mm/s
mm Note 2	mm

Full scale	
1, 5, 10, 20, 30, 50 (g)	**50, 100, 200, 300, 500** (m/s^2)
0.5, 1, 2, 3, 5 (ips)	**15, 20, 25, 30, 45, 50, 100** (mm/s)
10, 20, 25, 100 (mils) Note 2	**0.2, 0.5, 1, 2, 3, 4, 5** (mm) Note 2

Detector type	Output type	F_{MIN} (Hz)	to	F_{MAX} (Hz)
RMS Peak Peak-to-peak	A, V, D	**0.2**	to	**200**
	A, V, D	**0.5**	to	**500**
	A, V	**1**	to	**1000**
	A, V	**10**	to	**1000**
	A, V	**2**	to	**2000**
	A, V	**5**	to	**5000**
	A	**10**	to	**10000**
	A	**20**	to	**20000**
True peak Note 1	A	**10**	to	**25000**

[1] True peak detection option available for Input/Output type "A" only.

[2] Displacement output option available for Input type "V" only.

6.2 Ordering Examples

iT150-A-100-RMS-A-g-1-10-10000	Acceleration in, 100mV/g, RMS acceleration out, FS=1 g, 10-10000 Hz
iT150-A-500-P-V-mm/s-2-5-5000	Acceleration in, 500mV/g, peak velocity out, FS=2 mm/s, 5-5000 Hz
iT150-A-10-TP-A-g-5-10-25000	Acceleration in, 10mV/g, true peak acceleration out, FS=5 g, 10-25000 Hz
iT150-V-500-PP-D-mils-10-0.5-500	Velocity in, 500mV/ips, peak-to-peak displacement out, FS=10 mils, 0.5-500 Hz

7 Ordering procedure and options

7.1 Step 1 - Input type

Specify the type of sensor to be connected to the transmitter, either an accelerometer or a velocity transducer.

Input type	
A	Acceleration
V	Velocity

7.2 Step 2 - Sensitivity

Specify the sensitivity of the sensor. Units are mV/g for acceleration and mV/ips for velocity.

Sensitivity	
10	mV/g
100	or
500	mV/ips

7.3 Step 3 - Detector type

Next, specify the desired detector type. Four types of power detectors are available.

Detector type	
RMS	True RMS
P	Peak (equiv.)
PP	Peak-to-peak (equiv.)
TP*	True peak

*True peak detector option available for input/output type "A" only.

The properties and behavior of each type of detector are explained in the following sections.

7.3.1 RMS

An RMS power detector operates on frequency domain (FFT) data. It computes the true RMS power level of the input signal by summing the power levels of all FFT bins in the measurement bandwidth. Due to averaging, an RMS detector is relatively insensitive to brief spikes of vibration and other transients and tends to smooth the signal response.

True RMS detection is a very accurate method of determining the total power contained in a signal. It is used in vibration detection where it is desired to know the total amount of true vibration energy exhibited by a machine. The digital signal processor always calculates the true RMS power level of the input signal and derives peak and peak-to-peak values from the RMS value.

7.3.2 Peak ("equivalent")

Peak detection can be selected when it is desired to know the peak value of the vibration. The peak value is calculated by multiplying the detected RMS power level by $\sqrt{2}$. This method of conversion results in an "equivalent" peak power value of the input signal. It is accurate only when the input signal consists of a pure sinusoidal waveform. Since, in most cases, the vibration energy is primarily due to a single, high-level sinusoidal vibration, this method of peak detection works well.

Many vibration transmitters develop a peak value for vibration by using this method. The iT150 Series transmitters have this detection method available to provide comparable results to other vibration transmitters in use. It is also useful where users simply wish to have the signal output be in terms of peak vibration rather than RMS.

7.3.3 Peak-to-peak ("equivalent")

Peak-to-peak is simply two times the equivalent peak value. It is best used for displacement measurements. Select this detector option when plant maintenance records are in peak-to-peak units.

Tech tip! The choice of RMS versus equivalent peak detection is usually a matter of user preference. Both work from the same basic detection method. The choice is usually determined by local convention. Additionally, historical vibration data may be in terms of either RMS or peak vibration, and therefore the selection of vibration units can be in line with the plant's historical data.

7.3.4 True peak (Input/output type = "A" only)

Overview

The iT150 also offers a "True Peak" detector option. In contrast to an RMS power detector, which operates on the band-limited frequency domain data, the true peak detector operates on full bandwidth (10 Hz to 25 kHz) time domain waveform data. By operating on the raw data from the analog-to-digital converter, the true peak detector accurately responds to short-duration transients and impulses.

True peak detection is beneficial where it is desirable to capture short transient vibration events or where non-sinusoidal waveforms would cause large errors in an equivalent peak calculation, due to the presence of high frequency energy in the waveform. Some common mechanical causes of this type of energy are early bearing wear, chipped teeth in a gear set or mechanical faults capable of creating momentary impacts.

Response and decay times

Figure 1 illustrates the rapid response of the true peak detector to a transient event that would otherwise be missed by most vibration transmitters.

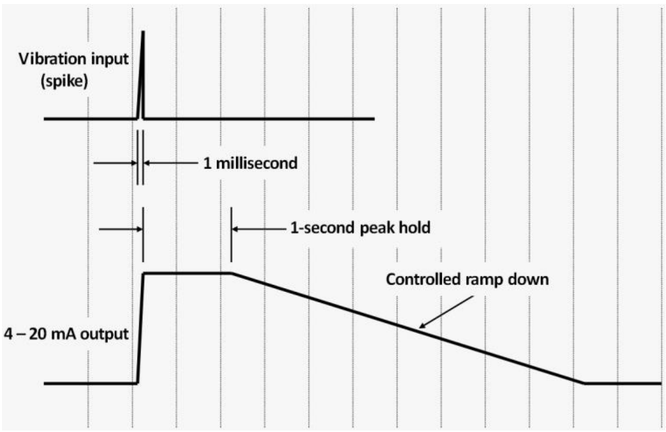


Figure 1 - True Peak detector behavior

Demonstrated in the figure is the response of the current loop output when the sensor input is presented with a very short-duration pulse (spike). The transmitter captures the spike and adjusts the 4-20 mA current very quickly to reflect the short-duration transient increase in vibration. Here, the pulse is less than a millisecond in duration, yet the true peak detector is able to accurately capture, and hold, the peak level.

The output of the true peak detector holds at the captured peak level for one second to allow for the typical DCS/PLC system, scanning at one-sample-per-second, to be able to accurately detect and record the peak of the signal. If no additional peaks appear at that level, or higher, the output of the peak detector begins to ramp down at a controlled rate.

This response can be contrasted easily to the response of an RMS detector. Since the total energy contained in the spike is miniscule, an RMS detector will not see a significant change in total signal power.

7.4 Step 4 - Output type

The signal processor can perform a single-stage mathematical integration of the input signal, resulting in a velocity output from an acceleration input or a displacement output from a velocity input.

Note: The True Peak detector type does not allow for an integrated output. For this reason, the True Peak output type must be the same as the sensor type, which is Acceleration.

Specify the desired output type, depending on the sensor type. Note: **If the detector type = TP, the output type must be acceleration (A).**

Output type	
A	Acceleration
V	Velocity
D	Displacement

If an integrated output is selected, keep the following tips in mind:

1. The practical upper limit (F_{MAX}) for velocity measurements is approximately 5 kHz, as very little velocity energy is present at higher frequencies. For displacement, very little motion is detectable above 500 Hz.

2. Performance of the integrator will be improved by using a high sensitivity sensor (500 mV/g or 500 mV/ips) to increase the input signal level.

7.5 Step 5 - Measurement units

Specify the desired measurement units, depending on the output type.

Output type	Measurement units	
Acceleration	**g**	**m/s/s**
Velocity	**ips**	**mm/s**
Displacement	**mils**	**mm**

Notes:

1. m/s/s = m/s^2
2. ips = inches per second
3. mm = millimeters
4. One mil = 0.001 inches

7.6 Step 6 - Full scale

Specify the 4-20 mA vibration full scale, depending on the measurement units:

Output type	Full scale	
Acceleration	**1, 5, 10, 20, 30, 50** (g)	**50, 100, 200, 300, 500** (m/s^2)
Velocity	**0.5, 1, 2, 3, 5** (ips)	**15, 20, 25, 30, 45, 50, 100** (mm/s)
Displacement	**10, 20, 25, 100** (mils)	**0.2, 0.5, 1, 2, 3, 4, 5** (mm)

When ordering, ensure the specified 4-20 mA full scale output is appropriate for the expected range of vibration. If the full scale value is too high, the 4-20 mA output may not respond adequately to low vibration levels. If the full scale value is too low, the loop may saturate at 20 mA.

7.7 Step 7 - Measurement frequency range

For detector types of RMS, P or PP, the frequency range must be specified. Specify the measurement frequency range, F_{MIN} to F_{MAX}, by selecting a range from the table below. There are eight ranges to choose from.

Note: For the True Peak detector type, the frequency range is fixed at 10 to 25,000 Hz (F_{MIN} = 10, F_{MAX} = 25000).

Frequency ranges for detector types RMS, P and PP

Detector type	Output type	F_{MIN} (Hz)	to	F_{MAX} (Hz)
RMS Peak Peak-to-peak	A, V, D	**0.2**	to	**200**
	A, V, D	**0.5**	to	**500**
	A, V	**1**	to	**1000**
	A, V	**10**	to	**1000**
	A, V	**2**	to	**2000**
	A, V	**5**	to	**5000**
	A	**10**	to	**10000**
	A	**20**	to	**20000**
True peak	A	**10**	to	**25000**

Frequency range for true peak detector type

F_{MIN} (Hz)	to	F_{MAX} (Hz)
10	to	**25000**

Tech tip! Lower values of F_{MAX} require more time to collect and process a "block" of data. This has the effect of lengthening the amount of time for the RMS detectors to settle to their final values.

8 System diagrams

8.1 Major system components

#	Description
1	Sensor/transducer inputs
2	(Empty)
3	Buffered, dynamic outputs
4	(Empty)
5	4-20 mA current loop outputs
6	Power input
7	LED indicators
8	Buffered sensor output BNC connection
9	TBUS card-edge connector
10	DIN rail

Figure 2 - Major system components

8.2 Basic circuit diagram

Shown below are the major functional blocks of the transmitter.

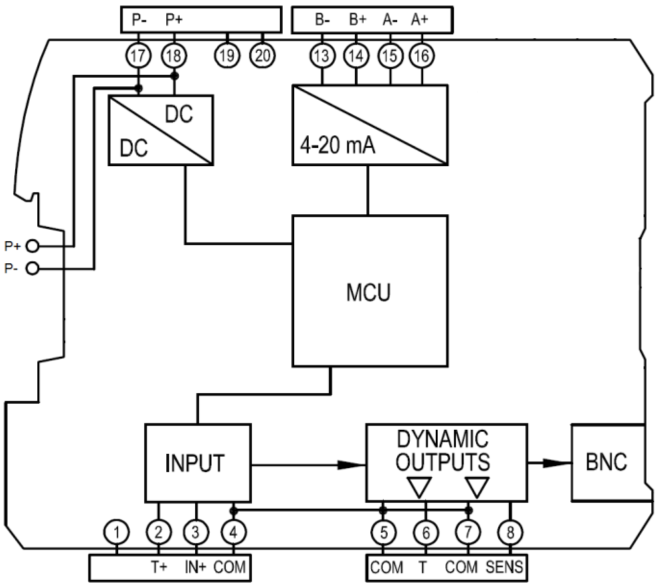


Figure 3 - Basic circuit diagram

8.3 Isolation diagram

The transmitter features 500 VAC functional isolation between three zones: power input, sensor input/output, and both 4-20 mA current loops. Figure 4 shows the isolation zones.

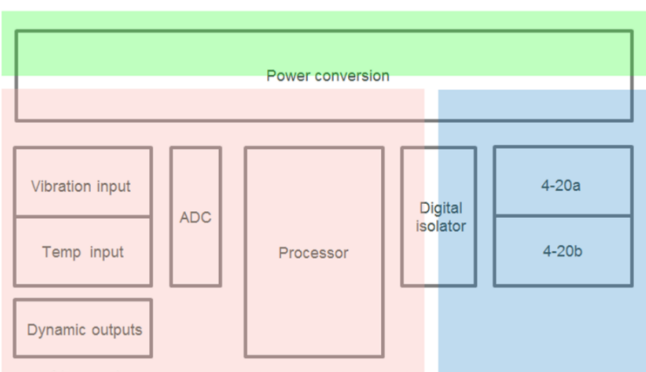


Figure 4 - Isolation diagram

⚠ CAUTION! Functional or operational isolation is necessary only for the correct functioning of the product. It does not protect or isolate against electrical shock.

9 Front panel LEDs

Two LEDs, located on the front panel, indicate the transmitter's status.

PWR

The green PWR LED indicates on/off status.

○	OFF	Unit not powered
●	ON	Normal operating mode

ERR

The red ERR LED indicates system and connection faults.

○	OFF	No faults – normal operation
●	ON	Sensor fault (priority)
✷	BLINKING	4-20 mA loop fault

See the section on "Troubleshooting" for information about correcting fault conditions.

10 IO ports and signal assignments

10.1 Terminal block locations and pin numbers

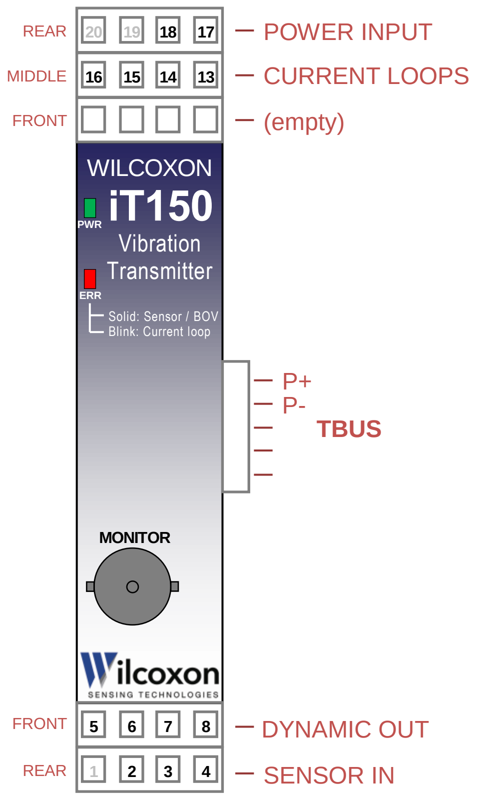


Figure 5 - IO port and terminal block locations

10.2 Terminal block pin and signal assignments

IO Port	Terminal numbers and signal assignments
Sensor (vibration + temperature)	1 – No connection 2 – Temperature sensor in (T+) 3 – Signal in / Sensor Power (IN+) 4 – Circuit Common (COM)
Temperature dynamic output	5 – Circuit Common (COM) 6 – Temperature out (T)
Sensor dynamic output	7 – Circuit Common (COM) 8 – Sensor out (SENS)
4-20 mA Loop B (Temperature)	13 – B- 14 – B+
4-20 mA Loop A (Vibration)	15 – A- 16 – A+
Power input	17 – P- 18 – P+

Table 1 - Terminal numbers and signal assignments

11 Electrical connections and wiring

11.1 ESD precaution

CAUTION! electrostatic discharge

Although the transmitter contains ESD suppression devices on all IO ports, components still can be damaged or destroyed by large magnitude electrostatic discharge. When handling the module or making electrical connections, observe the necessary safety precautions against ESD according to EN 61340-5-1 and IEC 61340-5-1. This will reduce the possibility of damage caused by ESD.

11.2 Pluggable terminal blocks

CAUTION! Electrical connections should not be made with power applied to the module.

All electrical connections to the transmitter are made using pluggable terminal blocks. The removable terminal blocks have screw terminals for easy wiring and are uniquely keyed to ensure correct installation into the various transmitter IO ports.

The terminal blocks accept 12 AWG through 24 AWG size wire (cable cross section: 0.2...2.5 mm²).

To make a connection to a terminal block:

1. Strip wire to 0.25" (6.4 mm)
2. Optionally, install a ferrule onto the wire and crimp securely
3. Insert the wire into the terminal block
4. Use a flat-blade screwdriver to tighten the screw to a torque of 0.6 Nm (2.1 oz/in)

11.3 Sensor/transducer connections

11.3.1 Vibration sensor

Connect the IEPE vibration sensor as shown in "Figure 6 - Sensor connections".

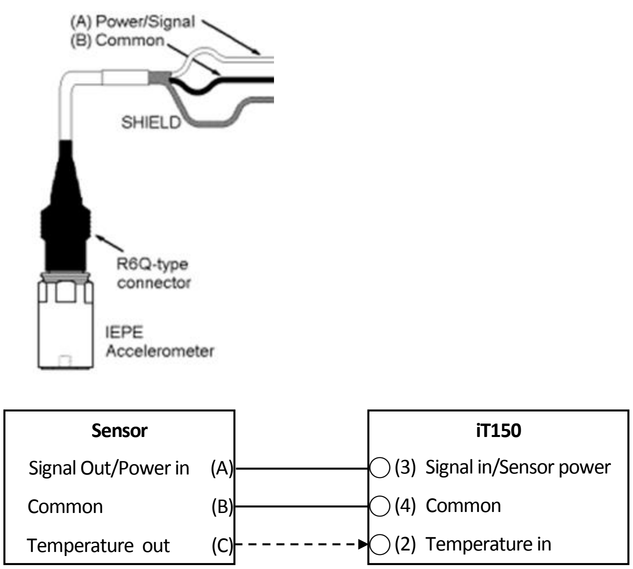


Figure 6 - Sensor connections

A built-in current source supplies a nominal 4.5 mA to the attached sensor.

11.3.2 Temperature sensor

The transmitter supports a 786T-type (or compatible) accelerometer with temperature sensor with a sensitivity of 10 mV/°C. The input voltage range for the temperature signal is 0 to +1.2 VDC.

A 786T accelerometer with a temperature output utilizes the temperature input on terminal #2. The temperature portion of the sensor is powered by the accelerometer circuit.

Before being passed to the processing circuitry and dynamic output terminals, the temperature input signal is low-pass filtered to remove noise and high frequency content.

Connection of a temperature sensor is optional.

11.4 Front-panel BNC sensor output

A buffered, unfiltered version of the AC vibration sensor signal, riding on the BOV, is available on the front-panel BNC connector. This allows live, on-line signal analysis and testing of the sensor. This analog output is a buffered version of the raw, unfiltered sensor signal allowing full spectrum analysis.

The BNC output is short circuit protected and has an output impedance of 50 Ω.

Note: When connecting a portable data collector or online monitoring system to the dynamic outputs, the external meter's internal constant current source, if so equipped, should be turned off. Failure to do so may result in a corrupted waveform.

11.5 Dynamic output terminal block connections

The buffered vibration signal is also available as a terminal block output. This output is in parallel with the front-panel BNC connector.

A buffered and low-pass-filtered version of the temperature sensor signal, if applicable, is available as a terminal block output.

The dynamic outputs are short circuit protected and have a 50 Ω output impedance.

Connect the dynamic outputs to the monitoring equipment as shown in the diagram. The use of shielded, twisted pair cable is recommended.

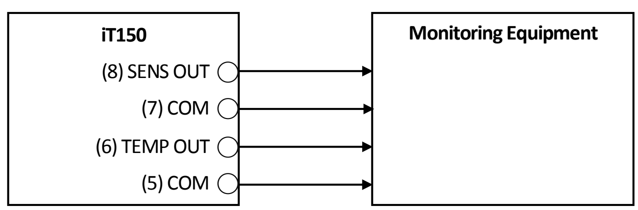


Figure 7 - Dynamic output connections

11.6 4-20 mA current loop connections

The transmitter provides two analog 4-20 mA current loop outputs, referred to as “Loop A” and “Loop B.” Loop A current is proportional to the vibration level and Loop B current is proportional to the measured temperature, if a temperature sensor is connected. These outputs are usually wired to a Programmable Logic Controller (PLC) or a Distributed Control System (DCS).

Both current loop outputs are “active.” That is, the outputs source the voltage and current for the loops and are designed to be connected to a passive, resistive load. The total loop resistance, including the load resistor, should not exceed 500 Ω.

Route the Loop A output (vibration) to a compatible monitoring system as shown, being careful to use a properly sized load resistor. The use of shielded, twisted pair cable is recommended.

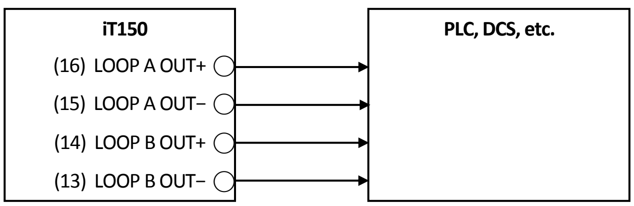


Figure 8 - 4-20 mA current loop connections

The iT150 is shipped with a zero-ohm jumper installed across the Loop B terminals. This is to prevent an open-loop fault condition in cases where the Loop B temperature output is not required or otherwise remains unconnected. If a temperature sensor is present and the Loop B output is required, remove the jumper and connect the Loop B output to the monitoring equipment. Store the jumper in a safe location so that it is available for future use, if needed.

Loop compliance voltage is 15 volts, ±5%. The current loop outputs are electrically isolated from all other internal circuitry and are protected from short circuits.

⚠ Caution: The transmitter sources the voltage and current for both loops. The 4-20 mA outputs will not work with externally powered loops.

11.7 Power supply connections

A 24-volt DC power source is normally used to power the transmitter. To provide greater installation flexibility, the power source voltage may range from 11 volts to 32 volts DC. This allows the use of power supplies with outputs other than 24 volts. The power inputs are protected from a reverse polarity condition and are electrically isolated from all other internal circuitry.

Connect the power source to the power input terminals, as shown. The module may also be powered via the TBUS.

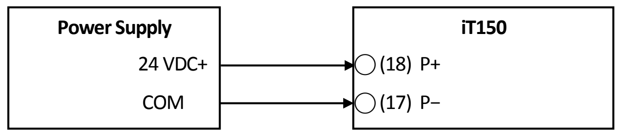


Figure 9 - Power supply connections

⚠ WARNING: The supply voltage must not exceed 33 volts or damage to the module may occur.

⚠ WARNING: The maximum current handling capacity of the power supply terminals is 4 amps. When using these terminals to supply power to the TBUS, do not exceed the 4-amp rating.

11.8 Cable shielding and earth ground connections

Shielding and proper earth grounding are important for the mitigation of interference and proper operation of the transmitter. A good shield connection prevents egress of transmitted signals and ingress of interfering sources. Faulty shield connections, along with the presence of external sources of interference, can adversely affect signal integrity. Ensure all cable shields are properly terminated and connected correctly, as required by the application.

There is no "shield" or earth ground connection on the transmitter module. Cable shields should be properly connected to protective earth (PE) ground external to the transmitter, as called for by the application. For best electrical performance, cable shields should be terminated as close as possible to the transmitter.

Wilcoxon provides enclosures with integrated grounding bus bars that are located in proximity with the DIN rail. The bus bar should be connected to a central earthing point using short, low-impedance connections with a large surface area.

To facilitate connecting cable shields to earth ground, DIN-mount shield connection clamps and grounding terminal blocks are available from Wilcoxon. See section 22, "Accessories" for a complete list of items to complement the installation and operation of the transmitter.

The type of shield connection should be determined by the expected operating environment:

- Connecting the shield at only one equipment end works to suppress interference caused by electrical fields.
- Connecting the shield at both equipment ends works to suppress interference caused by dynamic magnetic fields.

The iT150 features galvanic isolation between three circuit "zones" to help prevent ground loops (See section 8.3, "Isolation diagram" for more information.) However, the possibility of ground loops still must be considered when cable shields are connected at both equipment ends.

12 TBUS

The TBUS allows power to be supplied to multiple modules without the need for external wiring. Connection to the TBUS is made via a recessed board-edge connector, located on the rear of the module, and a IT032 connector. The board-edge fingers plug directly into the connector.

WARNING: The iT150 TBUS is NOT compatible with older Wilcoxon iT100/200, iT401 or iT501 series modules. When connecting modules via the TBUS, connect only iT150/300 series modules together on the same bus. Do not connect any other types of modules or devices to the TBUS. Doing so may result in damage to the modules.

Power can be bused to all modules via shared P+ and P- supply rails on the TBUS card-edge connector. This allows one module to supply power to other modules on the bus. The location of the terminals is shown below. The positive TBUS terminal (P+) is nearest the power input terminal block.

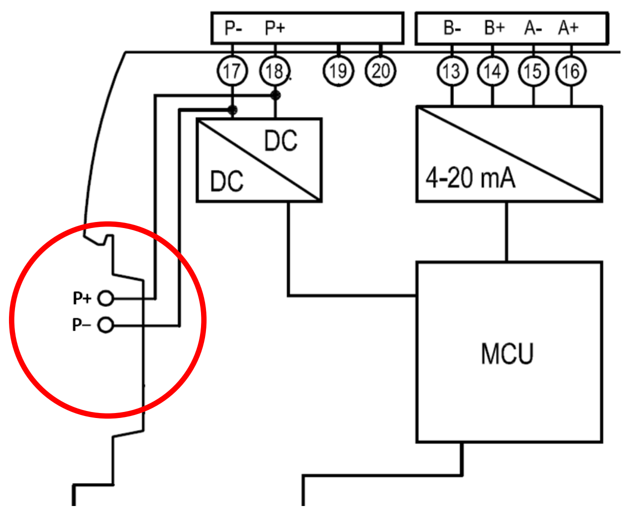


Figure 10 - TBUS power terminals

WARNING: The maximum current handling capacity of the TBUS terminals is 4 amps. When powering via the TBUS, ensure the 4 amp rating is not exceeded.

13 Power-up

After all wires are connected, power can be applied to the module. The module begins its power-up sequence immediately after power is applied. There is no on-off switch.

During power-up, the front-panel LED indicators will illuminate for three seconds while a self-check is performed. After the unit has completed its self-check, the green PWR LED will remain on. If the transmitter passes its self-test and the sensor and 4-20 mA loop(s) are connected correctly, the red ERR LED will be off.

See section 9, “Front panel LEDs” for detailed explanation of LEDs and unit operating status.

14 Operation

14.1 Sensor input

The transmitter has been designed to accept signals from piezoelectric (IEPE-type) accelerometers, velocity transducers and other compatible sensors that have a BOV (DC bias level) of approximately 12 volts. This allows the maximum input signal swing without clipping. If the BOV deviates significantly from 12 volts, the maximum allowable input signal swing and dynamic range will be reduced accordingly. The analog input circuitry is powered by regulated +24 VDC.

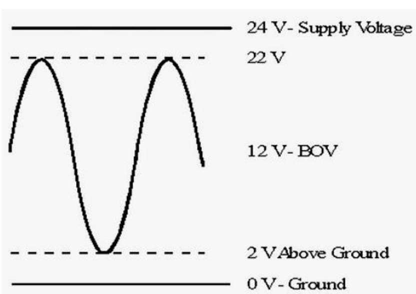


Figure 11 - Maximum input signal swing with 12V BOV

14.2 Sensor fault indication

The transmitter continuously monitors the BOV of the sensor signal. **If the BOV falls outside the 5-16 volt range, a sensor fault will be indicated.** When a sensor fault is detected, the front-panel ERR LED ● will illuminate.

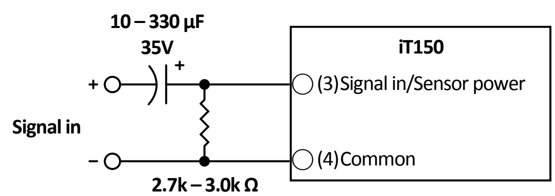
The transmitter complies with Namur NE43 recommendations for indicating a sensor fault to a control system by means of the 4-20 mA signal. If the transmitter detects a fault with the sensor BOV, the current in both loops will be set to 2 mA. A loop current of less than 4 mA conveys the fault condition to the 4-20 mA monitoring equipment.

If a sensor fault is indicated, the sensor BOV should be checked with an isolated (hand-held) DC voltmeter at the BNC connector and verified it is within the 5-16 volt range.

See “Troubleshooting” for more information on sensor faults.

14.3 RC coupling for non-standard signal sources

Signal sources not compliant with the BOV requirement can use the biasing circuit shown below. If more information is required, contact Wilcoxon technical support.



Capacitance	-3dB frequency
10 µF	6 Hz
47 µF	1.2 Hz
100 µF	0.6 Hz
330 µF	0.2 Hz

Figure 12 - RC coupling circuit for non-standard signals

14.4 Current loop faults

The transmitter continuously monitors the level of both loop currents and will indicate a fault condition if either set point current cannot be achieved. A loop fault is caused either by high loop resistance (>500 ohms) or an unconnected loop output. When a loop fault is detected, the ERR LED on the front panel will blink.

If a 4-20 mA output is not required by the application or is to remain unconnected, a jumper must be installed onto its screw terminals to prevent an open-loop fault condition from being detected by the transmitter. If the supplied jumper is not available, a short piece of hookup wire may be used.

See “Troubleshooting” for more information on current loop faults.

14.5 Loop current equations

14.5.1 Loop A - Vibration

Loop A current (I_A) is dependent on both the vibration level and full scale value as defined by the following equation:

$$I_A = \left(\frac{input\ level}{full\ scale} \bullet 16\right) + 4 \quad mA$$

The vibration level is given by:

$$\text{Level} = \left(\frac{full\ scale}{16}\right) \bullet (I_A - 4)$$

Example:

Sensor type = accelerometer
Sensitivity = 100 mV/g
Output type = acceleration
Full scale = 5 g

In the example, when the vibration level is equal to 5 g (500 mV), the loop current will be 20.0 mA. When the vibration level is equal to 1 g (100 mV), the loop current will be 7.2 mA.

14.5.2 Loop B - Temperature

If a temperature sensor is connected, Loop B current (I_B) is proportional to the measured temperature (0.133 mA/°C). Full scale is 120 °C.

Loop B current is defined by the following equation:

$$I_B = \left(\frac{T}{120} \bullet 16\right) + 4 \quad mA$$

Temperature is given by:

$$T = 7.5 \bullet (I_B - 4)$$

where T is temperature in degrees Celsius.

Examples:

0 °C = 4.0 mA
24 °C = 7.2 mA
120 °C = 20.0 mA

15 DIN rail assembly and removal

15.1 Requirements for installation

To protect the module from harsh conditions, it is recommended to install the unit in a suitable enclosure (NEMA 4 type, or equivalent) with the appropriate degree of environmental protection. In all cases, the enclosure must meet the requirements of the installation.

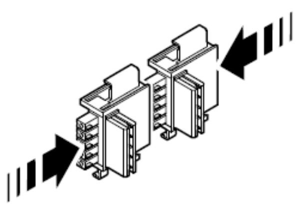
15.2 DIN rail mounting

The iT150 Series of modules are designed to mount to a standard 35 mm DIN rail. The rear of the module has a spring-loaded metal foot catch that holds the module securely in place. The module is installed onto the rail by simply snapping it into place.

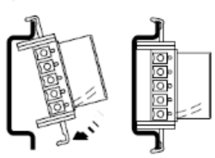
Each module is 22.5 mm wide and therefore occupies 22.5 mm of DIN rail space.

15.3 Preparing the DIN rail TBUS connectors

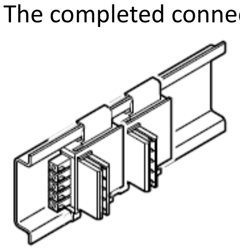
Connect the required number of connectors by pushing them together, as shown.



Attach the connectors to the DIN rail by hooking the latch of the connectors over the top of the rail and then snapping the bottom of the connectors onto the rail.

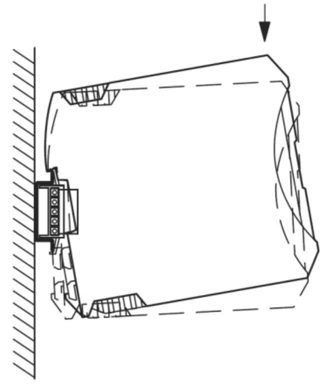


The completed connector assembly on the rail.



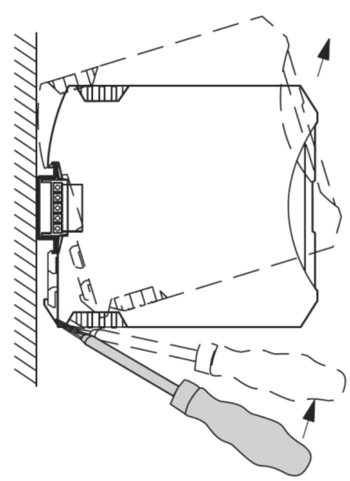
15.4 Installing the module onto the DIN rail

With the module tilted up, as shown, hook the top lip of the module onto the top of the rail while carefully aligning the DIN rail connector with the card edge slot on the rear of the module. Gently push the module downward and toward the rail. Firmly seat the module so the DIN TBUS connector fully engages the module card edge connector. The metal foot catch should audibly snap onto the rail. The module is now mechanically secured to the rail.



15.5 Removing the module from the DIN rail

Locate the metal foot catch on the bottom rear of the module. The catch is spring loaded. To remove the module from the rail, insert a small, flat-blade screwdriver or other suitable tool into the foot catch slot. (The blade must be less than ¼ inch (6 mm) in width to fit into the slot on the latch.) Using the screwdriver as a lever, gently push the screwdriver upward, as shown, to release the locking mechanism. With the catch released, tilt the module upward and remove it from the rail and connector.



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16 Troubleshooting

This section contains a list of common problems that may be encountered while using transmitter and recommended techniques for resolving the problems.

16.1 Fault conditions

The red ERR LED ● is on
Problem: Sensor fault (BOV out of range)
Possible causes:
1. Sensor not connected
2. Incompatible sensor
3. Shorted sensor wiring
4. Damaged/faulty sensor

- Verify a compatible sensor is connected.
- Use an isolated DC voltmeter to check the DC voltage at the BNC connector. The DC bias must be in the range of 5 to 16 volts. If outside this range, check sensor wiring.
- Try another sensor

The red ERR LED is blinking
Problem: Current loop fault
Possible causes:
1. One or both 4-20 mA outputs not connected (loop open)
2. Loop resistance too high

- Ensure both loops are connected to a valid load.
- If a loop output is not required by the application, ensure the supplied jumper is installed onto the loop terminals.
- Use an ohmmeter to measure the loop resistance. Total resistance should be less than 500 ohms.

16.2 Current loop outputs

Current loop A output (vibration) not as expected (non-integrated output)
Possible causes:
1. Incorrect sensor type
2. Incorrect sensor sensitivity
3. Incorrect transmitter configuration

- Ensure the sensor type matches that of the attached sensor.
- Ensure the sensitivity matches that of the attached sensor.
- Verify the power detector type, output type, measurement units and full scale.
- Verify F_{MIN} and F_{MAX} are appropriate for the speed of the machinery being monitored.

Current loop A output (vibration) not as expected
(velocity output from acceleration input or displacement output from velocity input)

Possible causes:
1. High level of low frequency energy
2. Sensor signal too low

- Specify a higher frequency range to reduce low frequency content.
- Use a high sensitivity sensor (500 mV/g) to increase input signal level.

Current loop B output (temperature) not as expected
Possible causes:
1. No temperature sensor connected
2. Incorrect temperature sensor sensitivity
3. Faulty sensor

- Ensure a 786T or compatible sensor is connected.
- Ensure the sensor sensitivity is 10 mV/°C.
- Try another sensor.

Current loop outputs "stuck" at 2 mA
Description: Current in both loops remains at 2 mA
Possible causes:
1. Sensor fault

- Check front panel ERR LED for BOV fault indication
- Verify a compatible sensor is connected.
- Check sensor/transducer wiring.
- Use an isolated DC voltmeter to check the DC voltage at the front-panel BNC connector. Ensure the sensor DC bias is within the acceptable range.

17 Application example

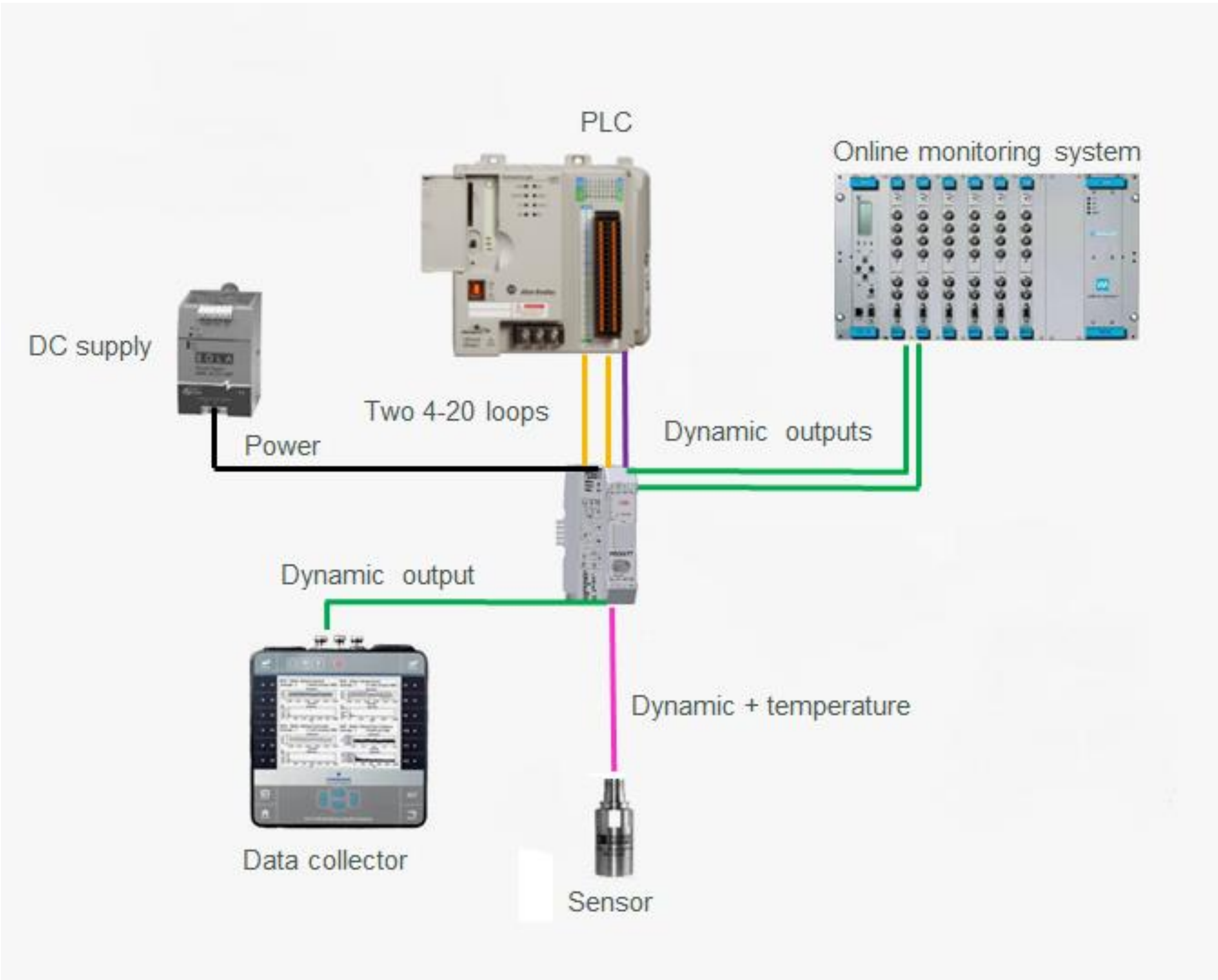

Figure 13 - Application example

18 Maintenance and calibration

The iT150 series transmitters contain no user-serviceable parts. All units are factory-calibrated and require no field adjustment or service. The units have been designed to provide years of continuous, trouble free service under normal operating conditions.

19 Warranty

Visit the Wilcoxon web site at www.wilcoxon.com for warranty information.

20 Customer service

To obtain a return materials authorization (RMA) number, please contact customer service at 301-330-8811, or fax to 301-330-8873.

21 Technical assistance

When calling for technical support or warranty information, have ready the following information: Model number, serial number.

For technical assistance, please contact Wilcoxon's technical support department:

Phone: 301-330-8811
Fax: 301-330-8873
email: info@wilcoxon.com

22 Accessories

Spring shield connection clamp
– Phoenix Contact SKS 8-SNS35, Order No. 3062786

Grounding terminal block
– Phoenix Contact UT 2,5/1P-PE, Order No. 3045033

23 Technical data

Mechanical	
Mounting	35 mm DIN rail, snap fit
Housing dimensions (W / H / D)	22.5 mm / 99.2 mm / 114.5 mm
Housing material	Polyamide
Housing color	Light gray
Weight, including terminal blocks	147.2 grams (5.19 oz.)
Environmental	
Operating temperature range	-40 °C to +70 °C (-40 °F to +158 °F)
Storage temperature range	-40 °C to +85 °C (-40 °F to +185 °F)
Humidity, non-condensing	0 – 95%
Altitude limit, operating	0 – 3000 meters
Degree of protection	IP20, (touch-safe) per IEC60529
Inflammability class	V0, according to UL 94
Shock	100g peak, 3 axis, 5 times each axis, 500µs half sine per IEC 60068-2-27
Vibration	10g random vibration per IEC 60068-2-34
Terminal blocks	
Connection method	Screw terminals
Conductor cross section, solid and flexible	0.2 mm^2 ... 2.5 mm^2
Conductor gauge	12 – 24 AWG
Stripping length	0.25” (6.4 mm)
Tightening torque	0.6 Nm
Power input	
Supply voltage range	11-32 VDC, reverse polarity protected
Absolute maximum ratings	±33 VDC
Current consumption, max.	125 mA @ 24 VDC, (275 mA @ 11 VDC, 95 mA @ 32 VDC)
Power consumption, max.	3 W
TBUS current rating	4 A
Surge voltage category	II
Isolation	500 VAC
Sensor input	
Input type	Singled-ended, DC coupled
Sensitivity	User defined
Frequency response	0.2 Hz – 20 kHz (-3 dB, -0.1 dB)
Frequency response (True Peak)	10 Hz – 25 kHz
Full-scale input range	+12 VDC ±10 volts (20 volts peak-to-peak)
Dynamic range	>90 dB
IEPE power source	+24 VDC ±5% @ 4.5 mA ±25% (25 °C). No damage from continuous short.
Analog-to-digital converter	24 bits, ΔΣ
ADC sampling rate	48.828 kbps
Initial accuracy	±1% of full scale
Number of FFT lines	1,600
FFT window type	Hanning

Technical data (continued)

Temperature input	
Sensor type	786T / 787T
Sensitivity	10 mV/°C
Input range	0 – 1.2 VDC
Initial error	±2 °C
Sensor and temperature dynamic outputs	
Coupling	DC
Output impedance	50 Ω
Minimum load resistance	10k Ω
Short circuit protection	No damage from continuous short
4-20 mA current loop outputs	
Current range	2.0 – 20.0 mA
Sensor fault indication	NAMUR NE43 compliant
Compliance voltage	15 V, ±5%
Maximum loop resistance	500 Ω
Short circuit protection	No damage from continuous short
Isolation	500 VAC

Certification	
Conformance	
Safety	EN61010-1:2001 – Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 1: General requirements UL508 – Safety standard for industrial control equipment EN50178 – Electronic equipment for use in power installations
EMC	EN61000-6-2:2005 Electromagnetic compatibility (EMC), Generic standards – Immunity for industrial environments EN61000-6-4:2007 Electromagnetic compatibility (EMC), Generic standards – Emission standard for industrial environments EN61326-1:2006 Electrical equipment for measurement, control and laboratory use - EMC requirements – General Requirements EN61326-2-3:2006 Electrical equipment for measurement, control and laboratory use - EMC requirements - Particular Requirements - Test configuration NAMUR NE 21 EMC recommendations

24 Revision history

DATE	REV	PAGE	SECTION	DESCRIPTION
01/18	A	-	Document	Initial release
10/18	A.1		Document	Company address changed
01/19	A.2	4, 6, 9	3, 6.1, 7.7	Added frequency range 10-1,000 Hz

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.