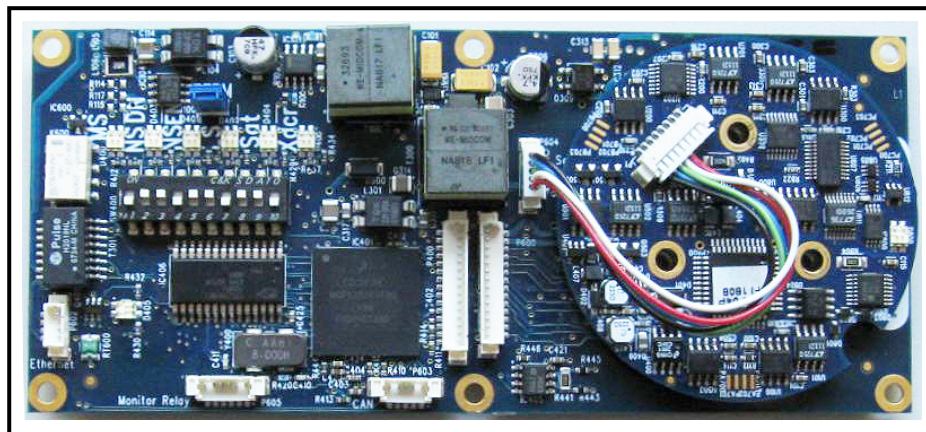# ATI INDUSTRIAL AUTOMATION

**ISO 9001 Registered**

*9105-NETOEM and 9105-NETAOEM*

# Net F/T OEM

Technical Data, Installation, and Operation Manual



**Document #: 9610-05-1027**
January 2012

*Engineered Products for Robotic Productivity*

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### Note

Please read the manual before calling customer service. Before calling, have the following information available:

1. Serial number (e.g., FT01234)
2. Transducer model (e.g., Nano17, Gamma, Theta, etc.)
3. Calibration (e.g., US-15-50, SI-65-6, etc.)
4. Accurate and complete description of the question or problem
5. Computer and software information. Operating system, PC type, drivers, application software, and other relevant information about your configuration.

If possible, be near the F/T system when calling.

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# How to Reach Us

**Sales, Service and Information about ATI products:**

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# Glossary

| Terms | Definitions |
|---|---|
| DHCP | Dynamic Host Configuration Protocol (DHCP) is an automatic method for Ethernet equipment to obtain an IP address. The Net F/T system can obtain its IP address using DHCP on networks that support this protocol. |
| Ethernet Network Switch | Ethernet network switches are electronic devices that connect multiple Ethernet cables to an Ethernet network while directing the flow of traffic. |
| F/T | Force/Torque. |
| IP Address | An IP Address (Internet Protocol Address) is an electronic address assigned to an Ethernet device so that it may send and receive Ethernet data. IP addresses may be either manually selected by the user or automatically assigned by the DHCP protocol. |
| MAC Address | MAC Addresses (Media Access Control Addresses) are the unique addresses given to every Ethernet device when it is manufactured, to be used as an electronic Ethernet serial number. |
| UDP | UDP (User Datagram Protocol) is a low-level method of transmitting data over Ethernet. While UDP is faster than TCP, unlike TCP lost UDP data is not resent. |
| Net Box | The component that contains the power supply and network interfaces of the Net F/T system. |
| PCB | Printed Circuit Board |
| RDT | Raw Data Transfer (RDT) is a fast and simple Net F/T protocol for control and data transfer via UDP. |
| Sensor System | The assembly consisting of all components from the transducer to the Net Box. |

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# 1. Safety

## 1.1 General

The customer should verify that the transducer selected is rated for maximum loads and moments expected during operation. Refer to F/T Transducer Manual (*9620-05-Transducer Section—Installation and Operation Manual*) found in Net F/T Installation and Operation Manual (*9610-05-1022*) or contact ATI Industrial Automation for assistance. Particular attention should be paid to dynamic loads caused by robot acceleration and deceleration. These forces can be many times the value of static forces in high acceleration or deceleration situations.

## 1.2 Explanation of Warnings

The warnings included here are specific to the product(s) covered by this manual. It is expected that the uses heed all warnings from the robot manufacturer and/or the manufacturers of other components used in the installation.

Danger indicates that a situation could result in potentially serious injury or damage to equipment.

Caution indicates that a situation could result in damage to the product and/or the other system components.

## 1.3 Precautions

**DANGER:** Do not attempt to disassemble the transducer. This will damage the instrumentation.

**DANGER:** Do not probe any openings in the transducer. This will damage the instrumentation.

**DANGER:** Take care to prevent excessive forces or moments from being applied to the transducer during handling or installation. The small Nano series is easily overloaded during rough handling and may be damaged.

# 2. System Overview

The NETOEM and NETAOEM are PCB-only versions of the NETB and NETBA Force/Torque sensor interface systems and do not include an enclosure. They provide the same functionality as their enclosed counterparts at a much lower weight and with smaller dimensions to be integrated in the customer's own housing. Please refer to the Net F/T manual for a description of the available functions: http://www.ati-ia.com/app_content/documents/9610-05-1022.pdf

## 2.1 NETOEM

The NETOEM is to be used in conjunction with a 9105-NET transducer, which has an integrated analog-to-digital interface. The NETOEM is recommended for all NET-GAMMA, NET-DELTA, NET-THETA and NET-OMEGA transducers.
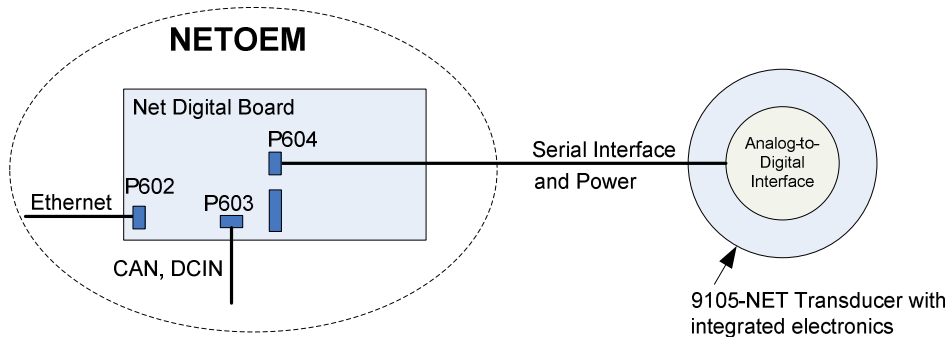


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**Figure 2-1—NETOEM System**

## 2.2 NETAOEM

The NETAOEM includes the analog-to-digital interface and allows the direct interface to 9105-TW transducers which do not have integrated electronics. The NETAOEM is recommended for all TW-NANO and TW-MINI transducers but can also be used with TW-GAMMA, TW-DELTA, TW-THETA and TW-OMEGA transducers.



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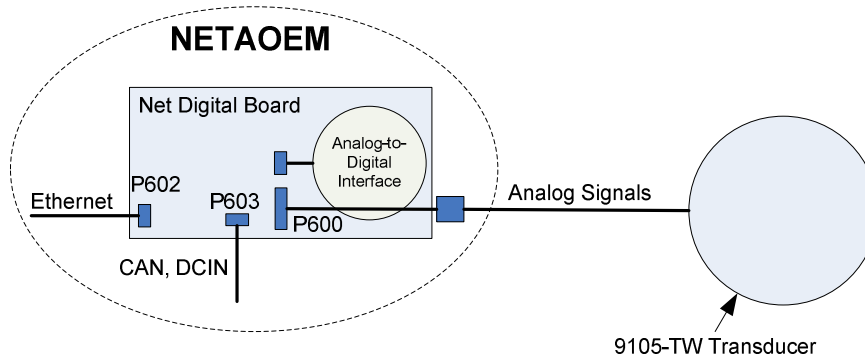
**Figure 2-2—NETAOEM System**

# 3. System Components Description

The NETOEM and NETAOEM consist of one or two PCBs and several optional wire harnesses.

## 3.1 9010-05-1040 Net Digital Board

The Net Digital Board communicates with the Net Analog Board (see section 3.2 "9010-05-1041 Net Analog Board") via a high-speed serial interface on P604. The received data are digitized strain data that get transformed into force and torque values on the Net Digital Board.

The Net Digital Board provides the force and torque data over an Ethernet and a CAN interface.

**9010-05-1040 Net Digital Board**

P604:
Connector to the Net Analog Board's Serial Interface and Power

P601
Connector to the Net Analog Board's Analog Inputs

P602
Ethernet Connector

P605
Connector for Threshold Relay

P603
CAN and Power Connector

Mounting hole should be connected to chassis ground for best performance.

P600
Connector for Transducer Strain Gages

**Figure 3-1—Net Digital Board – top view**
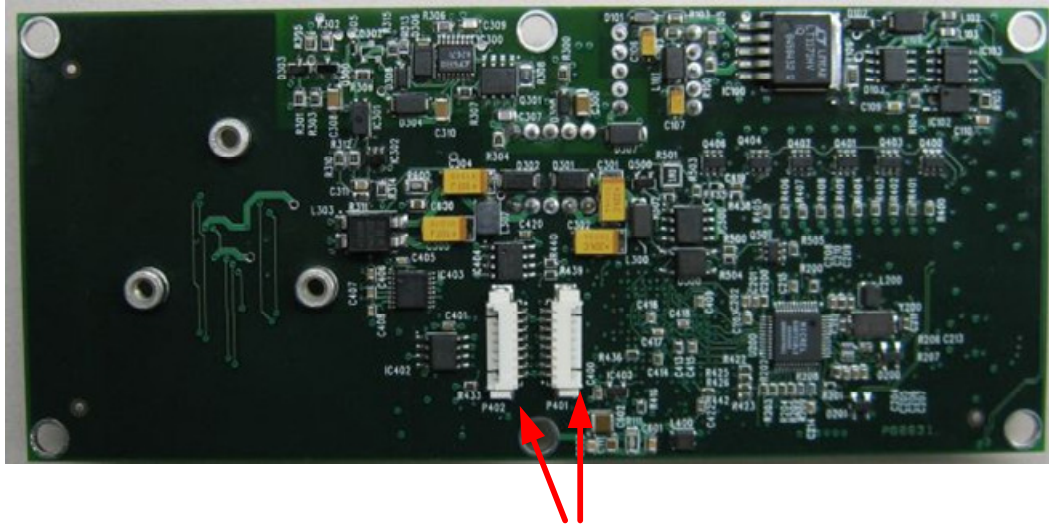
P400, P402: Do not connect

**Figure 3-2—Net Digital Board – bottom view**

## 3.2    9010-05-1041 Net Analog Board

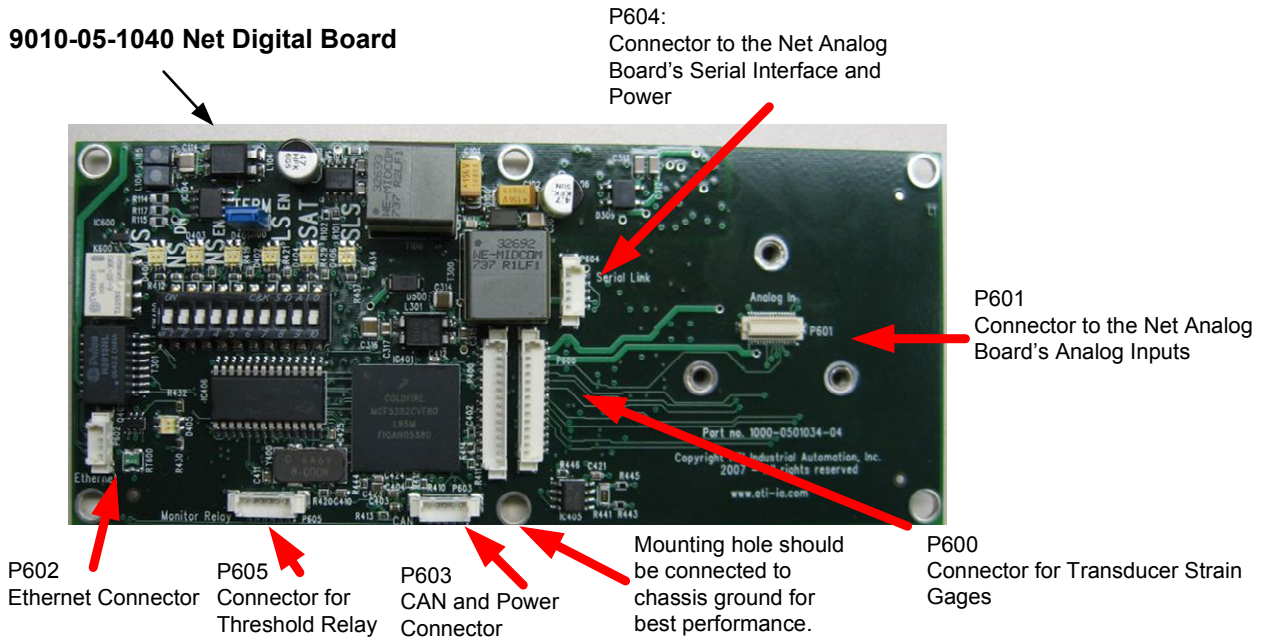The Net Analog Board interfaces with the transducer's strain gages via connector P2. The strain gage signals get digitized with 16-bit A/D converters. The digitized data are then sent over a high speed RS485 interface to the Net Digital Board via connector P1. 12VDC power from the Net Digital Board is supplied via P1.

The Net Analog Board is part of the NETAOEM and is connected to the Net Digital Boards connector P601. In NETOEM systems the Net Analog Board is located in the 9105-NET transducer.



P1
Serial Interface and Power
Connector
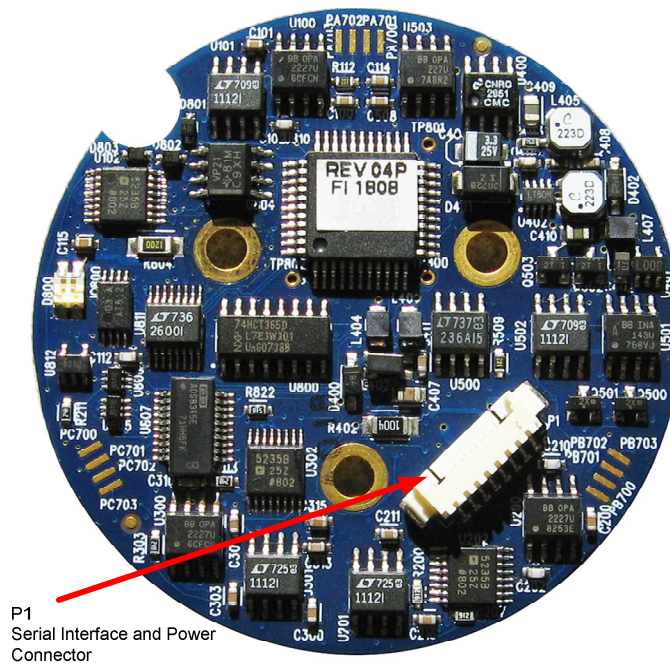
**Figure 3-3—Net Analog Board – top view**

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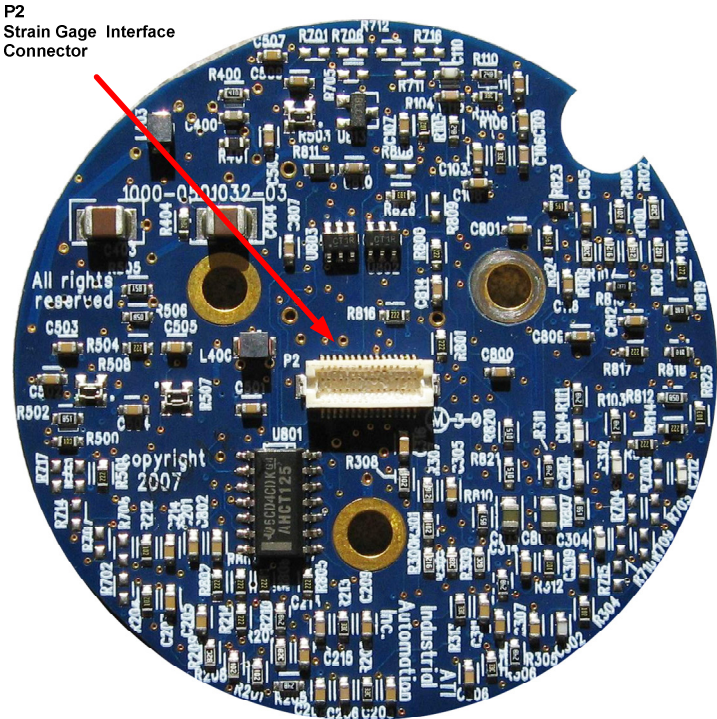
**Figure 3-4—Net Analog Board – bottom view**

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# 4.  Connectors

All user connectors are from Molex's Pico Blade family of connectors. Depending on the contact insert used, these connectors can accept wire sizes from 26 AWG (0.41 mm) to 32 AWG (0.20 mm).

## 4.1  Net Digital Board connections

### 4.1.1  P600 Transducer Strain Gage Connector

Mating connector housing:   Molex 51021-1400
Mating connector contact:    Molex 50058-8000 (28 – 32 AWG)
                             Molex 50079-8100 (26 – 28 AWG)

| Pin No. | Signal Name | Description |
|---|---|---|
| 1 | +VSG | Positive strain gage bridge supply voltage |
| 2 | -VSG | Negative strain gage bridge supply voltage |
| 3 | G0 | Strain gage 0 signal |
| 4 | G1 | Strain gage 1 signal |
| 5 | G2 | Strain gage 2 signal |
| 6 | G3 | Strain gage 3 signal |
| 7 | G4 | Strain gage 4 signal |
| 8 | G5 | Strain gage 5 signal |
| 10 | --- | Do not connect |
| 11 | --- | Do not connect |
| 12 | --- | Do not connect |
| 13 | --- | Do not connect |
| 14 | --- | Do not connect |

### 4.1.2  P602 Ethernet Connector

Mating connector housing:   Molex 51021-0400
Mating connector contact:    Molex 50058-8000 (28 – 32 AWG)
                             Molex 50079-8100 (26 – 28 AWG)

| Pin No. | Signal Name | Description |
|---|---|---|
| 1 | TX+ | Transmit data + |
| 2 | TX- | Transmit data - |
| 3 | RX+ | Receive data + |
| 4 | RX- | Receive data - |

### 4.1.3 P603 CAN and DC Power Supply Input Connector

Mating connector housing:    Molex 51021-0500
Mating connector contact:    Molex 50058-8000 (28 – 32 AWG)
                                        Molex 50079-8100 (26 – 28 AWG)

| Pin No. | Signal Name | Description |
|---|---|---|
| 1 | DCIN- | DC-supply  - input (0VDC) |
| 2 | CAN_L | CAN signal - |
| 3 | DRAIN | Shield for CAN signal cable |
| 4 | CAN_H | CAN signal + |
| 5 | DCIN+ | DC-supply +  input (+11VDC to +24VDC |

### 4.1.4 P604 Transducer Serial Interface Connector

Mating connector housing:    Molex 51021-0500
Mating connector contact:    Molex 50058-8000 (28 – 32 AWG)
                                         Molex 50079-8100 (26 – 28 AWG)

| Pin No. | Signal Name | Description |
|---|---|---|
| 1 | POWER_GND | DC Supply 0VDC output |
| 2 | RS485- | Serial Interface - |
| 3 | --- | reserved |
| 4 | RS485+ | Serial Interface + |
| 5 | DCIN+ | DC Supply + output ; 12VDC |

### 4.1.5 P605 Threshold Relay Connector

Mating connector housing:    Molex 51021-0600
Mating connector contact:    Molex 50058-8000 (28 – 32 AWG)
                                         Molex 50079-8100 (26 – 28 AWG)

| Pin No. | Signal Name | Description |
|---|---|---|
| 1 | COM_P | Common relay contact, protected[1] |
| 2 | NC_P | Normally closed relay contact, protected[1] |
| 3 | COM | Common relay contact |
| 4 | NC | Normally closed relay contact |
| 5 | NO_P | Normally open relay contact, protected[1] |
| 6 | NO | Normally open relay contact |

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[1] Protected means that a resettable fuse is in series to the relay contact and provides protection against over-current. See section 6.2.2 for more details.

### 4.2 Net Analog Board connections

#### 4.2.1 P1 Serial Interface and Power Connector

Mating connector housing: Molex 51021-0800
Mating connector contact: Molex 50058-8000 (28 – 32 AWG)
Molex 50079-8100 (26 – 28 AWG)

| Pin No. | Signal Name | Description |
|---|---|---|
| 1 | POWER_GND | Positive strain gage bridge supply voltage |
| 2 | RS485- | Serial Interface - |
| 3 | DRAIN | Shield for sensor signal cable |
| 4 | RS485+ | Serial Interface + |
| 5 | DCIN+ | DC Supply + output ; 12VDC |
| 6 | --- | Do not connect |
| 7 | --- | Do not connect |
| 8 | --- | Do not connect |

# 5. Optional Wire Harnesses

## 5.1 9000-05-1035 NETAOEM Transducer Strain Gage Wire Harness

The NETAOEM Transducer Strain Gage wire harness is only used with the NETAOEM, where it provides a connector interface between P600 of the Net Digital Board and a 9105-TW transducer. The 9105-TW transducer connector is a front-mount panel type and may be used on panels up to 0.197" (5mm) thick. The connector is keyed to the panel and is secured by a hex nut (included). The connector is not suitable for use in wet environments and has a rating of IP40.

Details and mechanical specifications may be obtained from Amphenol-Tuchel Electronics GmbH at http://www.amphenol.de/connector/T-3638-009/497.html

Cable length: about 4" (100 mm)



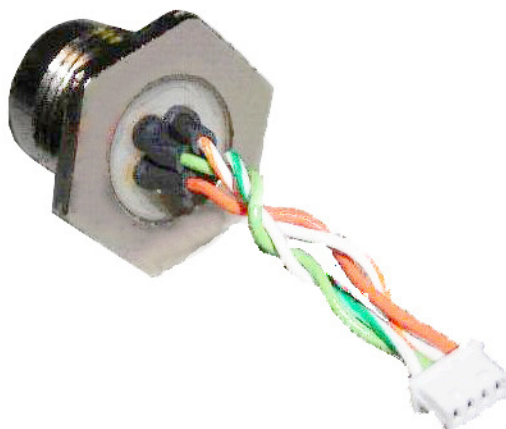**Figure 5-1—NETAOEM Transducer Strain Gage Wire Harness**

## 5.2 9000-05-1050 M12-4 Type D Ethernet Wire Harness

The M12-4 Type D Ethernet wire harness provides a connector interface between P602 of the Net Digital Board and an Ethernet cable with M12 connector.

Details and mechanical specifications for the M12-4 Type D Ethernet connector may be obtained from the manufacturer Turck under the part number FKFDDV-44

( http://www.turck-usa.com/Search/Documentation_Search_Results.asp?ViewID=Illustrations&Page=1&SearchIn=0&SortBy=&SortDesc=&Pattern=FKFDDV-44+ )

Cable length: about 1.25" (31 mm)
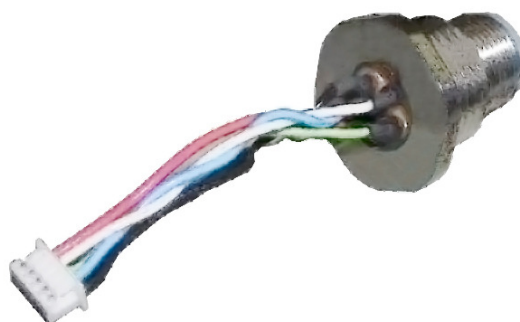
**Figure 5-2— M12-4 Type D Ethernet wire harness**

## 5.3  9000-05-1051 M12 Power/CAN Wire Harness

The M12 Power/CAN wire harness provides a connector interface between P603 of the Net Digital Board and a DeviceNet cable with M12 connector.

Details and mechanical specifications for the M12 connector may be obtained from the manufacturer Turck under the part number FSFDLV 57/S3039 -44

(ttp://www.turck-usa.com/Search/Documentation_Search_Results.asp?ViewID=Illustrations&Page=1&SearchIn=0&SortBy=&SortDesc=&Pattern=FSFDLV+57%2FS3039+)

Cable length: about 1.75" (44 mm)



**Figure 5-3— M12 Power/CAN wire harness**

## 5.4  9000-05-1052 NETOEM Transducer Wire Harness

The NETOEM Transducer wire harness is only used with the NETOEM where it provides a connector interface between P604 of the Net Digital Board and a 9105-C-MTR or 9105-C-MTS transducer cable with M12 connector. The ring terminal provides a connection to the cable shield and should be connected to the NETOEM enclosure's chassis ground for best EMC performance.
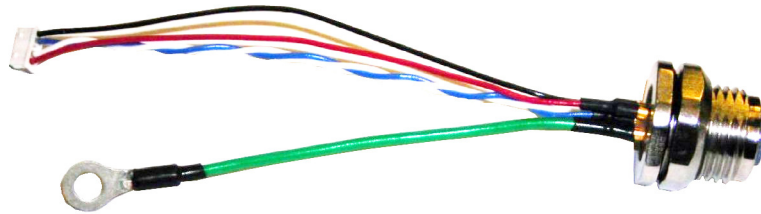
Details and mechanical specifications for the M12 connector may be obtained from the manufacturer Turck under the part number FKFDLV 57 / U3-10512

([http://www.turck-usa.com/Search/Documentation_Search_Results.asp?ViewID=Illustrations&Page=1&SearchIn=0&SortBy=&SortDesc=&Pattern=FKFDLV+57](http://www.turck-usa.com/Search/Documentation_Search_Results.asp?ViewID=Illustrations&Page=1&SearchIn=0&SortBy=&SortDesc=&Pattern=FKFDLV+57)+)

The ring terminal is designed for 0.164" stud size and has an outer diameter of 0.33".

Cable length to Molex connector:  about 3.5"  (88 mm)

Cable length to ring terminal: about 2.5" (63 mm)



**Figure 5-4— M12 NETOEM Transducer wire harness**

## 5.5   9000-05-1053 Threshold Relay Wire Harness

The Threshold Relay wire harness provides a connector interface between P605 of the Net Digital Board and a cable with 3-pin Pico connector.

Details and mechanical specifications for the 3-pin Pico connector may be obtained from the manufacturer Turck under the part number MFSS 3-0.2 / U7800

([http://www.turck-usa.com/Search/Documentation_Search_Results.asp?ViewID=Illustrations&Page=1&SearchIn=0&SortBy=&SortDesc=&Pattern=MFSS+3-0.2](http://www.turck-usa.com/Search/Documentation_Search_Results.asp?ViewID=Illustrations&Page=1&SearchIn=0&SortBy=&SortDesc=&Pattern=MFSS+3-0.2))

Cable length: about 1.25" (31 mm)

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**Figure 5-5— Threshold Relay Pico-to-Molex wire harness**

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# 6. Specifications

## 6.1 Storage and Operating Conditions

### 6.1.1 Temperature

|  | Storage Temperature, ℃ | Operating Temperature, ℃ |
|---|---|---|
| NETOEM | -40 to +100 | -20 to +80 |
| NETAOEM | -40 to +100 | -20 to +80 |

## 6.2 Electrical Specifications

### 6.2.1 Power Supply

| Power Source[†] | Minimum Voltage | Maximum Voltage | Maximum Power Consumption |
|---|---|---|---|
| Power over Ethernet[‡] through P602 | 36V | 57V | 6W |
| DCIN through P603 | 11V | 25V | 6W |

[†]Power is drawn from only one power source at a time.

[‡]Conforms to IEEE 802.3af, class 0, receiving power from data lines.

### 6.2.2 Threshold Relay

The threshold relay contacts (NC_P, NO_P and COM_P on P605) are protected against overload by a resettable fuse. The maximum guaranteed fuse hold current is 50mA.

The unprotected relay contacts NC, NO and COM are specified for a max. current of 1A at 30VDC.
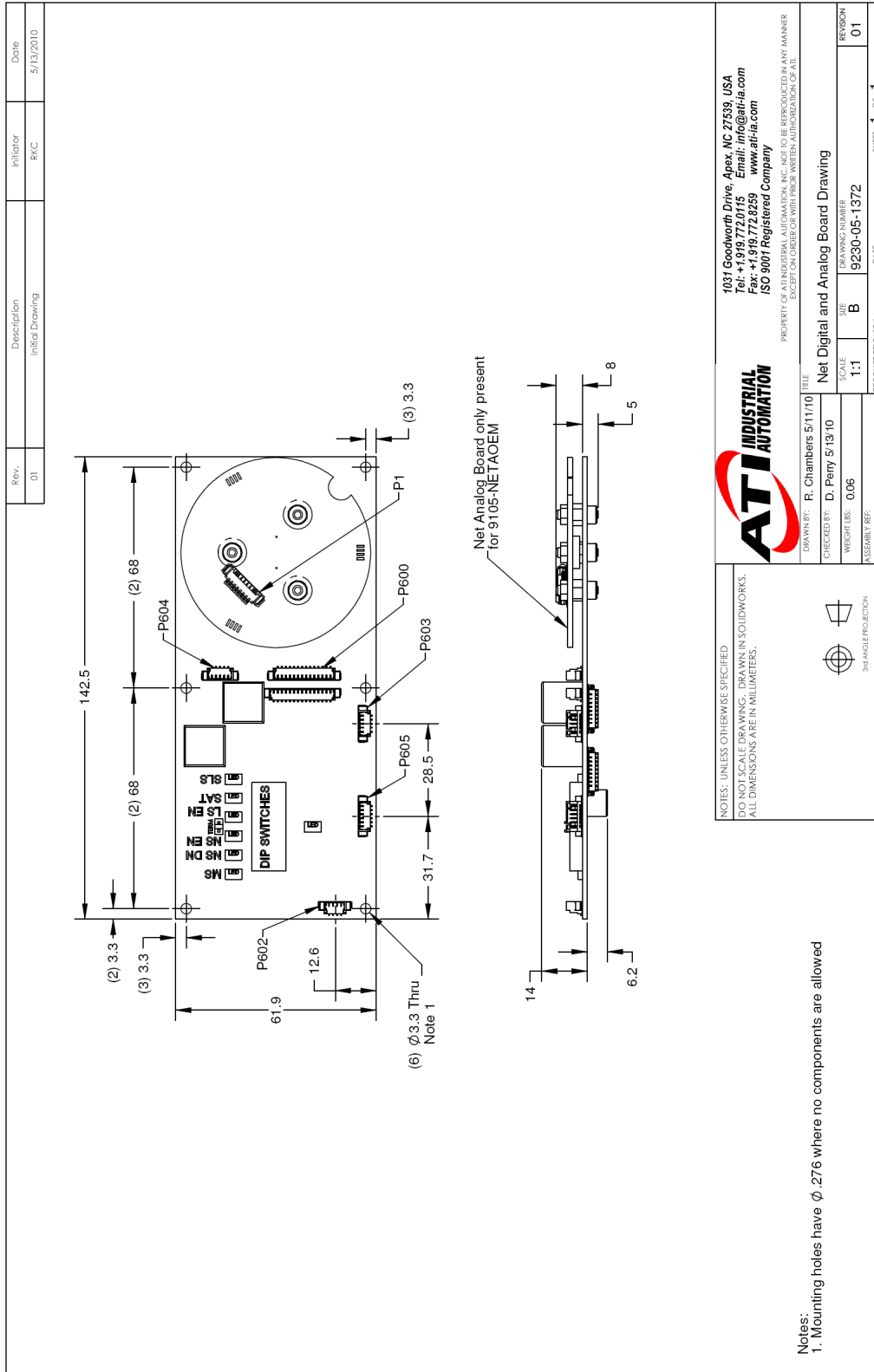
| Relay Contact Information | |
|---|---|
| **Rated load** | 0.3A at 125VAC, 1A at 30VDC |
| **Max. operating current** | 1A |
| **Max. operating voltage** | 125VAC, 60VDC |
| **Max. switching capacity** | 37.5VA, 30W |
| **Min. permissible load** | 10uA at 10mVDC |

## 6.3 Weights and Dimensions

| Component | Weight (approx.) | Dimensions |
|---|---|---|
| 9010-05-1040 Net Digital Board | 55g (1.94oz) | See drawing in Section 7.1 |
| 9010-05-1041 Net Analog Board | 14g (0.49oz) | See drawing in Section **Error! Reference source not found.** |

# 7. Drawings

## 7.1 9230-05-1372 Net Digital and Analog Board Drawing

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# 8. Terms and Conditions of Sale

The following Terms and Conditions are a supplement to and include a portion of ATI's Standard Terms and Conditions, which are on file at ATI and available upon request.

ATI warrants to Purchaser that force torque sensor products purchased hereunder will be free from defects in material and workmanship under normal use for a period of one year from the date of shipment. This warranty does not cover components subject to wear and tear under normal usage or those requiring periodic replacement. ATI will have no liability under this warranty unless: (a) ATI is given written notice of the claimed defect and a description thereof with thirty (30) days after Purchaser discovers the defect and in any event, not later than the last day of the warranty period and (b) the defective item is received by ATI not later than (10) days after the last day of the warranty period. ATI's entire liability and Purchaser's sole remedy under this warranty is limited to repair or replacement, at ATI's election, of the defective part or item or, at ATI's election, refund of the price paid for the item. The foregoing warranty does not apply to any defect or failure resulting from improper installation, operation, maintenance, or repair by anyone other than ATI.

ATI will in no event be liable for incidental, consequential, or special damages of any kind, even if TI has been advised of the possibility of such damages. ATI's aggregate liability will in no event exceed the amount paid by the purchaser for the item which is the subject of claim or dispute. ATI will have no liability of any kind for failure of any equipment or other items not supplied by ATI.

No action against ATI, regardless of form, arising out of or in any way connected with products or services supplied hereunder, may be brought more than one year after the cause of action accrued.

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