GUIDANT

Smith Meter® Networked Meter Block

Installation, Operation, and Maintenance Manual

Bulletin MNET001 Issue/Rev 0.0 (7/21)

Important

All information and technical specifications in this document have been carefully checked and compiled by the author; however, we cannot completely exclude the possibility of errors. Guidant is always grateful to be informed of any errors; contact us at GuidantMeasurement.com.

Caution

The default or operating values used in this document and in the configuration parameters of the Networked Meter Block are for factory testing only and should not be construed as default or operating values for your metering system. Each metering system is unique and each configuration parameter must be reviewed and programmed for that specific metering system application.

Disclaimer

Guidant hereby disclaims all responsibility for damages, including but not limited to consequential damages arising out of or related to the inputting of incorrect or improper program or default values entered in connection with the Networked Meter Block.

Technical Support

Field Service Response Center
24/7 Technical Support/Schedule a Technician: +1 844.203-4014

System installation supervision, startup, and commissioning services are available.

Customer Support

Customer Service
Guidant
1602 Wagner Avenue
Erie, PA 16510 USA
+1 814.898.5000

Contents

1 Introduction

This manual provides guidance for the installation, operation, and maintenance of the Smith Meter Networked Meter Block (NMB). When installed following the guidelines contained in this manual, the NMB should provide many years of safe, accurate, and reliable use.

1.1 Product Description

The NMB is a Ethernet network-enabled field input/output (I/O) device with the ability to connect peripheral devices to standard industrial infrastructure, especially cloud applications. It also is capable of local control, such as basic logic and closed loop algorithms. For example, it can communicate a meter's flow rate and additional data through open communication protocols. Users can access the meter data remotely over the network in near real-time and communicate back to the NMB using common tools, such as a Web browser.

The NMB makes it possible to eliminate much of the expense of today's multi-layered hardware infrastructures and specialized tools, reducing the overall cost to achieve total system integration. Additionally, NMB models with Turbine Meter Diagnostic firmware—developed specifically for liquid turbine meters—ensures the accuracy of measurements by detecting potential issues as they occur in real time.

1.1.1 NMB Models

Several models of the NMB are available, with a unique model code identifying each variant, such as NMB-XP-TMD-06. The following table provides details about the available options for your NMB and its model codes:

Table 1: NMB Model Codes

Block Type	Mounting Type	Firmware	Accessories
NMB: Networked Meter Block that interfaces directly with a digital meter pulse signal **NMT**: Networked Meter Block with a preamplifier front end to connect directly with low-voltage pickup coils on a turbine meter	**PM**: Panel mounted **XP**: Aluminum alloy explosion-proof instrument housing **SS**: Stainless steel explosion-proof instrument housing	**NMB-STD**: Standard firmware for raw I/O, meter, and communications **NMB-TMD**: Standard NMB firmware plus Turbine Meter Diagnostic firmware	**06**: Meter block and PA-6 turbine meter pulse transmitter (enclosure required) **11**: Meter block and PA-11 turbine meter pulse transmitter (enclosure required)

Additionally, the DIN rail mounting kit—designed to be used for a single panel-mounted NMB—also may be purchased with your NMB.

These models represent standalone versions of the NMB and are designed to be used for retrofit applications. You also may order the NMB as a factory-installed accessory when purchasing any of TechnipFMC's turbine or positive displacement (PD) meters.

1.2 Included Equipment

1.2.1 Integral Equipment

The following equipment is integral on the NMB:

- Two RJ45 port connections
- Three-port switch for ETH1, ETH2, and an internal processor
- Light-emitting diode (LED) for port speed and activity

1.2.2 Ancillary Equipment

The following ancillary equipment is included with the NMB:

- 10/100Base-TX Ethernet cable (based on IEEE 802.3 standards)

1.3 Receipt of Equipment

When you receive your NMB, you should check the exterior packing case for any shipping damage.

> If the packing case is damaged, contact the shipping carrier immediately regarding their liability.

Carefully remove the unit from the exterior packing case and inspect it for damaged or missing parts. Ensure you received your purchased options. For details about NMB models and optional accessories, see Table 1: NMB Model Codes.

Prior to installation, the unit should be stored in its original packing case and protected from adverse weather conditions and abuse.

> If the NMB is damaged or parts are missing, a written report must be submitted to:
>
> Guidant
> c/o Inside Sales Department, Measurement & Production Solutions
> PO Box 10428
> Erie, PA 16514

1.4 Storage Instructions

To ensure your NMB is not corroded or damaged by moisture or water before being installed, it must be properly stored using the following instructions:

- Keep the unit in a dry, protected location.
- Avoid storing the unit outside; if you must store it outside, ensure it is protected from the elements.
- For NMBs purchased with an instrument housing, use the following additional storage guidelines:

- Ensure the conduit port on the back of the instrument housing is closed with the factory-provided ¾-inch NPT plug.
- Retain the factory-provided vapor desiccant sack, which should be secured with double-sided tape inside the housing.
- Keep the cover mounted to the instrument housing to protect the electronics.
- If your NMB is installed, but is awaiting start-up or commissioning, use the following guidelines to protect your unit:
  - Use a conduit seal-off fitting based on applicable electrical codes.
  - Do not leave the unit installed with an open seal-off fitting or cover removed.

1.5 Warnings and Precautions

Before you begin, please read all of the following warnings and cautions to reduce the risk of injury, equipment damage, or malfunction.

1.5.1 Configuration

The NMB is shipped from the factory in a completely initialized state and must be properly configured for the specific installation prior to operation. The unit will not operate properly until the configuration is completed. Configuration parameters can be set using a personal computer's (PC) Web browser via the Web browser interface.

1.5.2 Hazardous Locations

Some models are approved for use in an explosive environment (Class I, Division 1, Groups C and D and Zone 1 Ex d ia, IIB Gb), but specific installation methods are required to produce a comprehensive explosion-proof system. This manual only provides guidance for the installation of the NMB and using its firmware. In general, keeping the front cover closed in accordance with the instructions is key to maintaining explosion protection, along with following all local installation codes and requirements.

> Any modification of the instrument housing invalidates the hazardous location rating of the NMB. For example, do not drill or machine the housing.

1.5.2.1 Precautions in Hazardous Locations

Note that when operating the NMB in hazardous locations, special care must be taken with shielding termination to ensure signal integrity (see Section 3.2.5: Typical Wiring Diagrams for more information).

ATEX-approved installations have special requirements; see Section 3.2.3: ATEX and IECEx Zone 1 Installations and Section 3.2.4: ATEX and IECEx Zone 2 Installations for details.

To ensure the correct operation, see Section 3.2.5: Typical Wiring Diagrams for field input/output wiring diagrams.

1.5.3 Electrostatic Discharge Precautions

Electronic components are susceptible to damage by static discharge. To minimize the risk of damage, the following precautions should be followed:

- Before touching a circuit board with hands or tools, personnel and tools should be grounded using a wrist strap.
- Avoid touching components or traces on the circuit boards and handle by the edges or mounting holes.
- Circuit boards should be kept in conductive bags when not installed.

1.5.4 RF Radiation

The NMB generates, uses, and can radiate radio frequency (RF) energy and, if not installed and used in accordance with this manual, may cause interference to radio communications. It has not been tested to comply with the limits pursuant to the Federal Communications Commission's (FCC) Code of Federal Regulations, Title 47, Part 15 (47 CFR 15), as electronic control equipment used by an industrial complex is exempt from these rules.

Operation of this equipment in a residential area may cause interference, in which case the user, at their own expense, will be required to take whatever measures that may be required to correct the interference.

1.5.5 Weights & Measures Requirements

The NMB is a device that is marketed for a global market. Requirements regarding weights and measures may vary depending on the region. Users are required to verify that the device is configured and operated in a manner consistent with local codes and that proper notification (permit for use) or registration has been filed with the local authority or jurisdiction for this type of device if used to transmit legally relevant data. This device is intended as a diagnostic tool.

2 Pre-Installation Considerations

2.1 Electrical Installation Considerations

In addition to the following installation recommendations, all previous warnings and cautions should be reviewed before installation.

> The following recommendations are based on our knowledge of electrical codes. Your local electrical codes should be reviewed to ensure that these recommendations follow the local code. Additionally, you should review the installation manuals for all the equipment being wired into the NMB for transmission distances and wire recommendations.

- All wiring into the NMB must be routed through the cable entries.
- The direct current (DC) signal wires must be shielded multi-conductor cable of 18 to 24 American wire gauge (AWG) minimum stranded copper.
- It is recommended that ferrules be installed on all stranded copper signal wiring.

> The NMB and ancillary electrical support equipment should only be installed by properly trained personnel. The installer must comply with all national and international regulations for their location regarding the installation of electrical systems.
>
> Substitutions within the NMB or other certified ancillary equipment is not allowed and will void Ex safety certifications.

2.1.1 Power Supply

The NMB requires an external power supply (not included) with a voltage range between 12 to 24 volts direct current (VDC). The power supply must be assigned a switch or power-circuit breaker (suitable for the area's hazardous classification) so the primary side of the power supply can be easily disconnected from the alternating current (AC) mains electric power. The switch or power-circuit breaker should be clearly marked as to its function.

We recommend that the power supply meet one of the following standards, depending on your local jurisdictions:

- EN/IEC/UL/CSA 62368-1
- Safety Extra Low Voltage (SELV)
- Protective Extra Low Voltage (PELV)
- United Laboratories (UL) 508
- National Electrical Code (NEC) Class 2

> Always follow the manufacturer's recommendations and warnings when installing the power supply.

For additional details about the power supply, see Section 3.3.1: Power Supply.

2.1.1.1 Division 2/Zone 2 Hazardous Area Considerations

If the user-supplied power supply will be mounted in a control cabinet located in a Division 2/Zone 2 hazardous area, it must be certified for use in that area. The complete system requires certification, including but not limited to the evaluation of the NMB, power supply, connectors, fuses, internal wiring, and routing that is required to complete the control cabinet or panel. The standards used for these hazardous locations include UL ANSI/ISA 12.12.01 (Division 2) and EN/IEC 60079-7 or EN/IEC 6079-15 (Zone 2); additional standards may apply.

The NMB is rated to be mounted in Class I, Division 2, Groups C and D or Zone 2 Ex ec IIB hazardous locations with a temperature rating of T4 over the ambient temperature range of -40 °C to 60 °C. When choosing a certified power supply, ensure it has been evaluated for shock and personal safety of ignition hazard assessments, which include the maximum surface temperature expected during operation at maximum-rated ambient temperatures.

> To maintain these ratings, the selected power supply must meet or exceed these ratings; otherwise, the ratings of the overall system will be that of the power supply.

2.1.2 External Fuse Protection

The NMB is equipped with a non-replaceable, internal fuse on the DC supply input to comply with required safety standards. To protect the internal fuse, an external, user-supplied over-current protection (maximum 1.0 amp fuse) should be integrated into the DC power system installation wiring to the NMB.

2.1.3 Typical Wire Sizes

Typical wire sizes used when installing the NMB are as follows:

Table 2: Typical Wire Sizes

Equipment	Number and Gauge of Wire	Belden Number or Equivalent
Transmitters	4/18 gauge 4/20 gauge	9418 8404
Temperature probes and density/ pressure transmitters	4/22 gauge	8729 or 9940
Ethernet	Cat 5 or Cat 6	1584A or 2412
DC power supply	2/20 gauge (maximum length of 750 feet/230 meters) 2/18 gauge (maximum length of 1,000 feet/300 meters) 2/16 gauge (maximum length of 1,500 feet/460 meters)	

> Maximum wire length accounts for point-to-point distance from the source to the device for supply and return.

2.2 Real-Time Clock Synchronization

Three Network Time Protocol (NTP) servers are configured to synchronize the NMB's clock with Coordinated Universal Time (UTC) the first time a connection is made between the servers and the NMB. Users cannot manually set or change the clock, nor select a time zone; however, you can change the servers to suit your location (see Section 4.3.7.2: Configuring NPT Server Settings).

> All timestamps by the NMB, such as those recorded in logs, are in UTC.

A coin cell battery maintains the clock's settings curing a power cycle. This battery may need to be replaced over time; for instructions, see Section 5.1: Replacing the Clock Battery.

3 Installation

3.1 Physical Installation

The following sections provide guidelines on installing your NMB when purchased as a standalone unit (without a Smith Meter Turbine or PD meter). Standalone NMBs can be panel mounted on a DIN rail or, when purchased with an explosion-proof instrument housing, directly mounted to a meter.

3.1.1 Installing a Panel-Mounted NMB

You can install a standalone NMB (without an enclosure) in nonclassified areas remotely from the meter, assuming the meter transmits pulses to an existing device, such as a flow computer or batch controller. The NMB's inputs can accept an amplified meter pulse train (such as those sent to a flow computer). The NMB's meter pulse inputs have sufficient impedance that operation of an existing flow computer should not be affected by sending pulse data into the NMB in parallel.

A standalone NMB can be wired the same as a meter-mounted NMB with a pulse transmitter included (such as Smith Meter's PA-6 Preamplifier; see Section 3.2.5: Typical Wiring Diagrams).

> The NMB is certified to allow installation into Class I, Division 2, Zone 2 hazardous locations when it is installed in an appropriate electrical enclosure with a minimum ingress protection (IP) rating of IP54.
>
> It is the installer's responsibility to ensure that all applicable local electrical safety codes are followed when integrating the Smith Meter NMB into a custom enclosure. It may be required that the complete electrical enclosure system be certified by a national authority.
>
> The NMB also may be installed in ordinary, non-hazardous locations and has been evaluated to Underwriters Laboratories (UL) 508 – Industrial Control Equipment, a standard regarding fire and shock safety. This standard also is used to satisfy the requirements of European Union (EU) Directive 2014/35/EU regarding low voltage.

The NMB can be mounted directly to a panel using the two through-holes. Optionally, it can be purchased with an 35-mm DIN rail mounting kit, designed specifically for a single panel-mounted meter block.

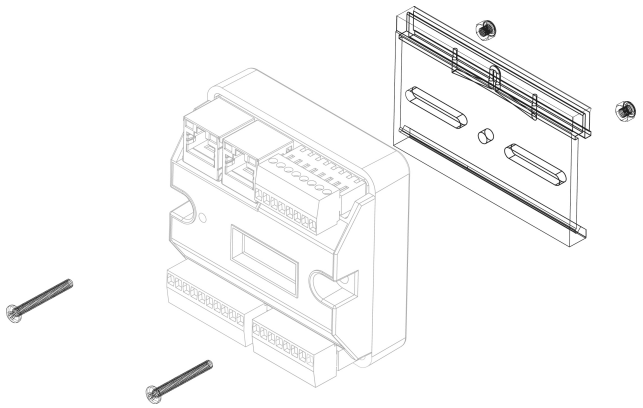
When planning a custom DIN rail layout, you must allow adequate spacing for air circulation around each NMB sharing the same DIN rail; a minimum of 6 mm (.24 inch) is recommended. Adequate spacing also should be allowed between any adjacent, parallel DIN rails for cable runs; a minimum center-to-center distance of 120 mm (4.7 inches) is recommended. The center-to-center distance used should also factor in the minimum spacing requirements for any other equipment mounted on the DIN rail.

The DIN rail mounting kit includes:

- One DIN rail mounting bracket
- Two M3 x .5 mm x 30 mm stainless steel screws
- Two M3 x .5 mm stainless steel locknuts

To install the NMB using the DIN Rail Mounting kit, first mount the DIN rail mounting bracket to the NMB using the supplied screws and locknuts. You can then mount the bracket to your DIN rail.

Figure 1: NMB with DIN Rail Mounting Kit



> This installation expects the bracket to be mounted to a standard 35 mm wide DIN rail, which is not supplied in this kit.

3.1.2 Installing the NMB with an Instrument Housing

An NMB purchased with an instrument housing is certified for installation in Class I, Division 1, Zone 1 and Class I, Division 2, Zone 2 hazardous locations. You also can install it in non-hazardous environments as it has been evaluated to UL 508 – Industrial Control Equipment, a standard regarding fire and shock safety; this standard also is used to satisfy the requirements of EU Directive 2014/35/EU regarding low voltage.

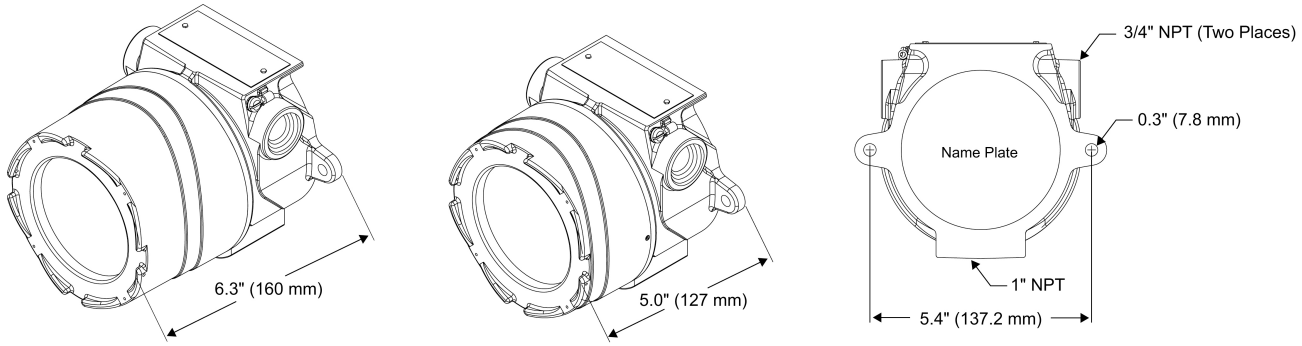
NMBs with an included instrument housing can be installed using one of the following methods:

- Mount the NMB directly to a meter using the instrument housing's 1-inch NPT conduit hub. When using rigid conduit systems, we highly recommend using conduit unions to later ease removing the NMB housing from the meter fitting for servicing.
- Mount the NMB to a panel or rack using the two integral mounting feet. All ancillary conduit fittings and cable glands must be certified according to your local electrical installation codes. Additionally, any fittings (stopping boxes) or cable glands are required to be sealed for Division 1, Zone 1 installations.

> It is the installers' responsibility to ensure that all applicable local electrical safety codes and installation practices are followed.

The following dimensional drawings are provided to help you plan the installation of the NMB's instrument housing.

Figure 2: Enclosure Installation



Extended Height Instrument Housing

Standard Height Instrument Housing

Back View

After installing your NMB, the qualified installer must indicate the type of environment in which the NMB was installed using a stamping die (such as an “x”) in the box next to the appropriate zone type on the housing’s name plate.

☐ Class I, Division 1, Zone 1 areas are identified as Ex db IIB T6 Gb -40 °C ≤ Ta ≤ 60 °C

☐ Class I, Division 2, Zone 2 areas are identified as Ex ec IIB T6 Gc -40 °C ≤ Ta ≤ 60 °C

3.1.3 Installing the NMB or NMT on a Turbine Meter

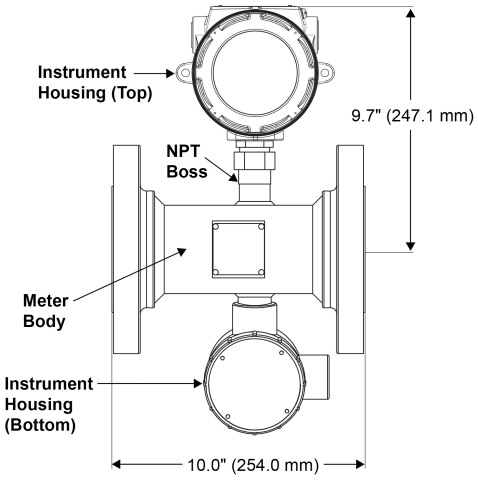
To communicate meter information, the NMB is designed to be easily connected to a turbine meter using traditional low voltage pickup coils. The following options are available for connecting the NMB with a turbine meter, depending on your NMB model:

- Models beginning with “NMB” directly interface with a digital meter pulse signal; for example, the output of a preamplifier, such as the Smith Meter PA-6 or PA-11 Preamplifier, (see Figure 9: Meter Pulse Inputs from a PA-6 Transmitter (NMB Models Only) for connections).
- Models beginning with “NMT” include a preamplifier front end so it can connect directly to a low voltage pickup coil (see Figure 12: Wiring the NMT Directly to Pickup Coils in Sentry, Guardsman, and MV Turbine Meters for connections).

> This direct-mounting method only allows access to one pickup coil. If you require access to both pick-up coils (such as for flow direction detection), remote mounting of the NMB is recommended so the signals are derived directly from the individual preamplifiers.

All Smith Meter turbine meters with pickup coils are supplied with a 1-inch NPT pickup boss. The NMB’s instrument housing may be directly mounted to the 1-inch NPT boss using a male/female (M/F) conduit union.

Figure 3: NMB Housing Directly Mounted to Smith Meter G Series Turbine Meter



3.1.3.1 Pulse Transmission

If long-distance pulse transmission is required to connect with other non-communicating ancillary equipment, we recommend using the NMB with a Smith Meter PA-6 or PA-11 Preamplifier, which can be purchased as accessories with an NMB. The pulse output from a preamplifier is used to send the meter pulse signal to the NMB’s pulse input and to other pulse input ancillary devices in parallel.

If long-line pulse transmission is not required, a 5 volt, peak-to-peak, 1:1 pulse output is available.

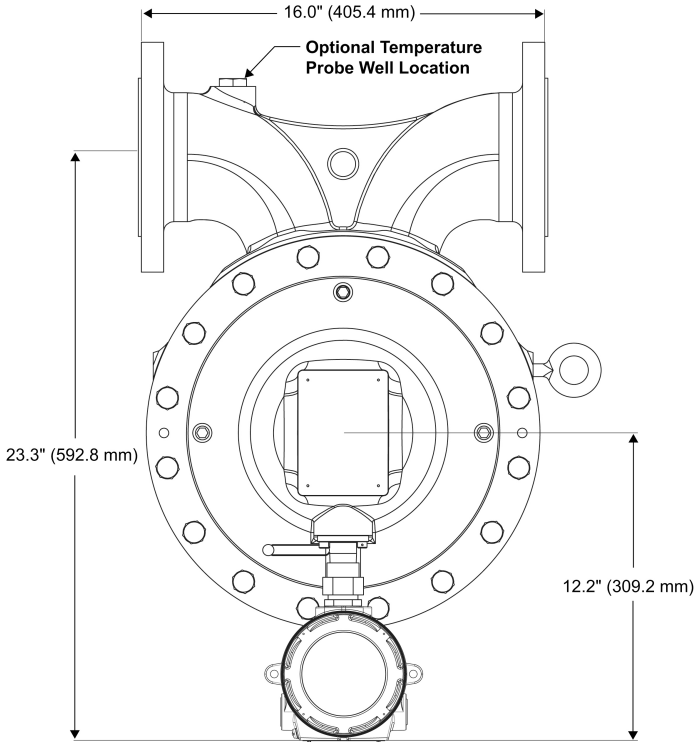
3.1.4 Connecting to a PRIME 4 or Genesis PD Meter

The NMB is designed to easily connect with Smith Meter electronic PD meters, such as the PRIME 4 or Genesis PD meter.

3.1.4.1 PRIME 4 Meter

The PRIME 4 meter is supplied with a male ¾-inch NPT sensor housing. You can directly mount the NMB to the sensor housing boss using a M/F conduit union and a 1-inch to ¾-inch NPT reducer fitting. See Figure 4: PRIME 4 Meter with NMB Instrument Housing for an example of connections from the PRIME 4 sensor to the NMB and Figure 10: Meter Pulse Inputs from a PRIME 4 PD Meter Pulser for an example of electrical connections.

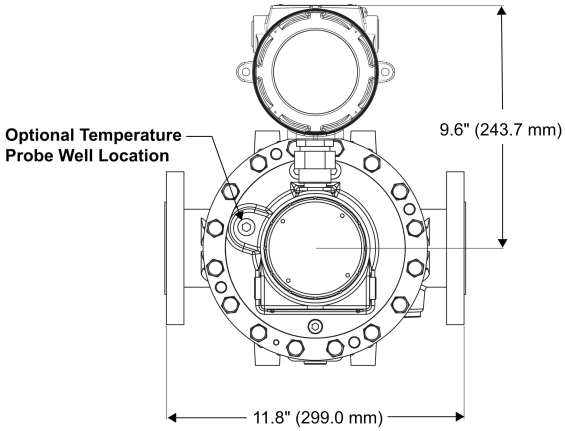
Figure 4: PRIME 4 Meter with NMB Instrument Housing



3.1.4.2 Genesis Meter

The Genesis meter is supplied with an integral housing with female ½-inch NPT conduit entrances. The NMB's instrument housing can be directly mounted to the Genesis meter's housing using a M/F conduit union and a 1-inch to ½-inch NPT reducer fitting. See Figure 5: Genesis Meter with NMB Enclosure for an example of connections from the Genesis Hall Rotary Encoder (HRE) circuit board to the NMB and Figure 11: Meter Pulse Inputs from a Genesis PD Meter's HRE Board (Configured with an RTD) for an example of electrical connections.

Figure 5: Genesis Meter with NMB Enclosure



3.2 Electrical Installation

3.2.1 Evaluation Standards Used

The following electrical standards were used in the evaluation of the NMB:

- General: IEC 60079-0 7th Edition, EN 60079-0:2018, UL 60079-0 7th Edition, CAN/CSA C22.2 No. 60079-0:2019
- Zone 1: IEC 60079-1 7th Edition, EN 60079-1:2014, UL 60079-1 7th Edition, CAN/CSA C22.2 No. 60079-1:2016
- Zone 2: IEC 60079-7 5th Edition, EN 60079-7:2015, UL 60079-7 5th Edition, CAN/CSA C22.2 No. 60079-7:2016

3.2.2 North American Installations

When installing in the United States, the NMB must be installed in accordance with the National Electrical Code (NEC) NFPA 70 following the specific requirements for the zone or division area declared.

When installing in Canada, the NMB must be installed in accordance with the Canadian Electrical Code CSA C22.1 following the specific requirements for the zone or division area declared.

3.2.3 ATEX and IECEx Zone 1 Installations

The following information is specific to NMB models purchased with an explosion-proof instrument housing (with “XP” or “SS” in the model code) that will be installed in Zone 1 locations:

- Cable entries must be in accordance with IEC 60079-1 Section 13.
- For wiring systems using cable glands, the gland or thread adapter must be Ex d IIB IP66 certified. The cable end must be securely installed and, depending on the cable type, must be properly protected from mechanical damage.

- For wiring systems using conduit, an Ex d certified sealing device must be used immediately at the entrance of the enclosure. Any unused entry must be suitably blocked with an Ex d IIB IP66 certified plug for ATEX and IECEx applications. For North American zone applications, the plug must be listed close up type.
- Wiring and cable glands must be suitable for 80 °C operation.
- Equipment bonding should be provided at the external grounding facility terminal; external connection is not required when using metallic conduit or armored cable. The external grounding facility terminal wire range is 10 to 12 AWG (4 mm^2 minimum).

> To prevent the ignition of hazardous atmospheres, disconnect from the power supply before opening the instrument housing. Keep the housing tightly closed when circuits are alive.
>
> The NMB contains an internal battery-powered circuit; to prevent the ignition of hazardous atmospheres, do not open the housing unless the area is known to be non-hazardous.
>
> To reduce the risk of ignition of hazardous atmospheres, conduit runs must have a sealing fitting connected within 2 inches (50 mm) of the housing.

3.2.4 ATEX and IECEx Zone 2 Installations

Although NMB models purchased with an explosion-proof instrument housing (with “XP” or “SS” in the model code) are certified for Zone 1, they also may be installed in a Zone 2 area using Zone 2 wiring practices. The appropriate zone check box is required to be marked on the instrument housing’s name plate to indicate which zone area wiring methods were used during the installation.

The following information is specific to NMB models purchased with an explosion-proof instrument housing that will be installed in ATEX and IECEx Class I, Division 2, Zone 2 environments:

- The input power terminal block is rated for a wire size range of 14 to 28 AWG (0.2 mm2 to 1.5 mm2).
- The tightening torque is 0.2 to 0.25 N·m (1.7 to 2.2 inch-pounds or 28 to 35 inch-ounces).
- The minimum wire temperature rating is 80 °C operation.

For NMB models that are panel mounted (with “PM” in the model code):

- The NMB should only be used in an area of not more than pollution degree 2, as defined in IEC/EN 60664-1.
- The NMB should be installed in an enclosure that provides a degree of protection not less than an IP54 rating in accordance with IEC/EN 60079-0 standards and only be accessible with the use of a tool.

For NMB models purchased with an instrument housing (with “XP” or “SS” in the model code):

- The area inside the instrument housing should maintain a pollution degree of 2, as defined in IEC/EN 60664-1.
- To minimize the risk of electrostatic charge, provisions should be made for adequate grounding and equipment should be installed in such a manner that accidental discharge should not occur.
- Any cable glands, thread adapters, or sealing fittings used should be certified Ex e, at a minimum.

3.2.5 Typical Wiring Diagrams

All of the terminals on the NMB are labeled to ease the process of landing the wiring connections. The following figures provide details for connecting external devices to the NMB. Callouts on the left side of the connector in each image are the NMB internals; callouts on the right of each connector represent external wiring/devices.

Figure 6: Power and Digital Output Connections

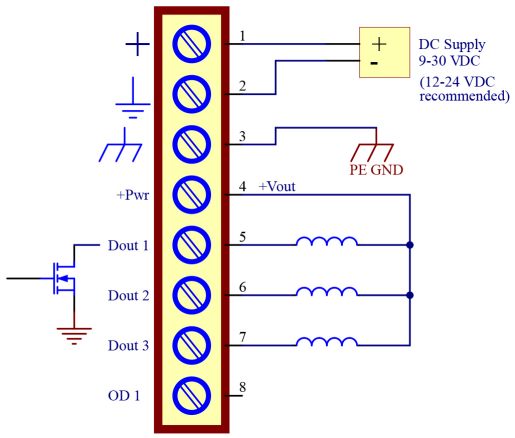


Figure 7: Digital Input Connections

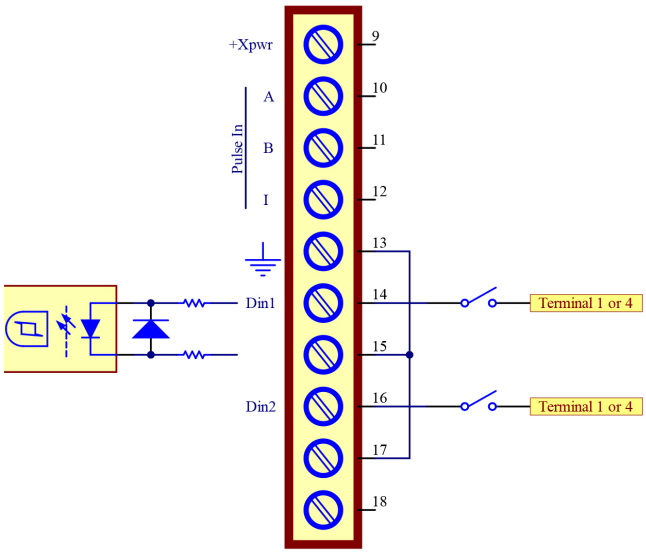


Figure 8: Analog Input Wiring (Four-Wire Platinum RTDs and Two 4-20 mA Inputs

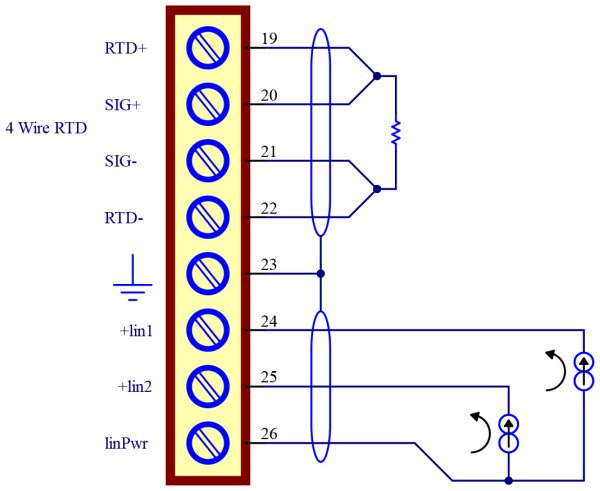


Figure 9: Meter Pulse Inputs from a PA-6 Transmitter (NMB Models Only)

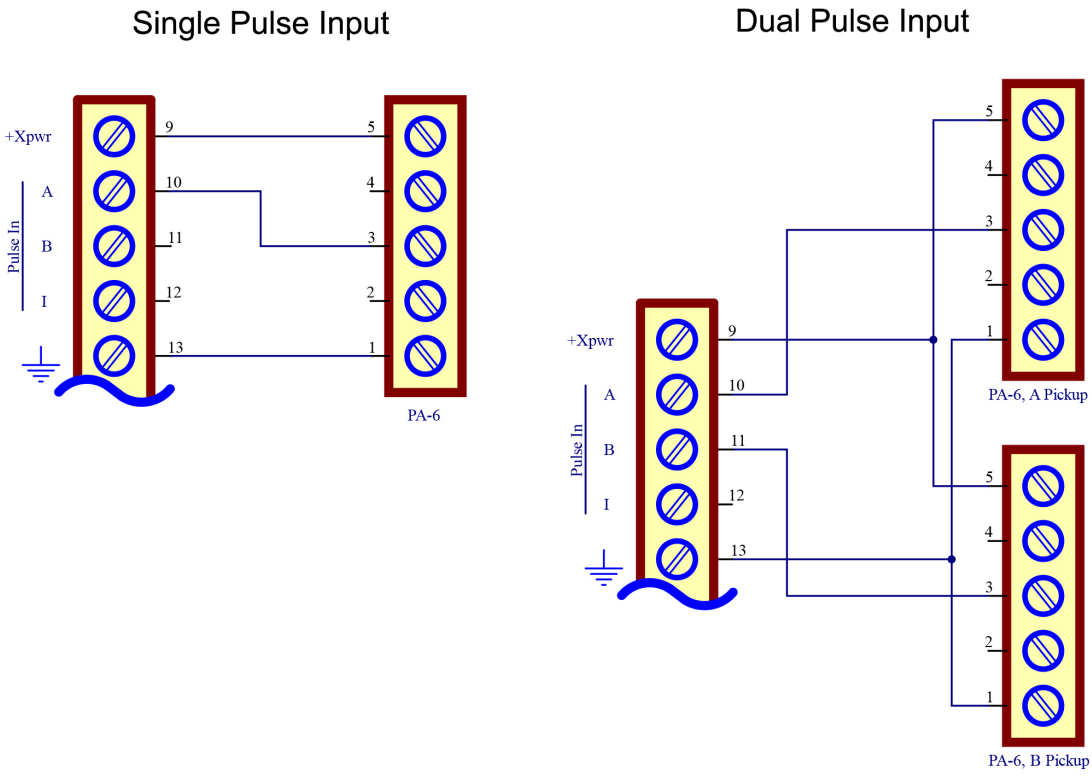


Figure 10: Meter Pulse Inputs from a PRIME 4 PD Meter Pulser

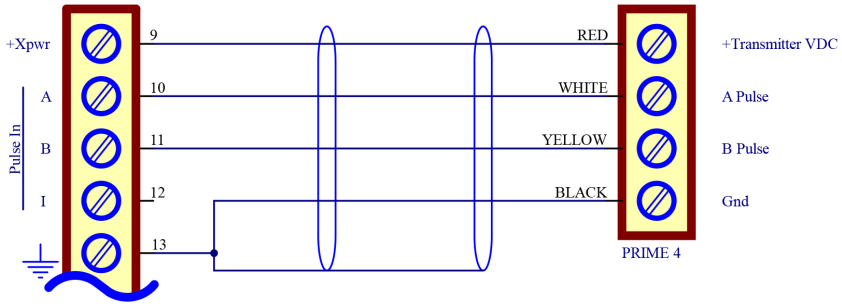


Figure 11: Meter Pulse Inputs from a Genesis PD Meter's HRE Board (Configured with an RTD)

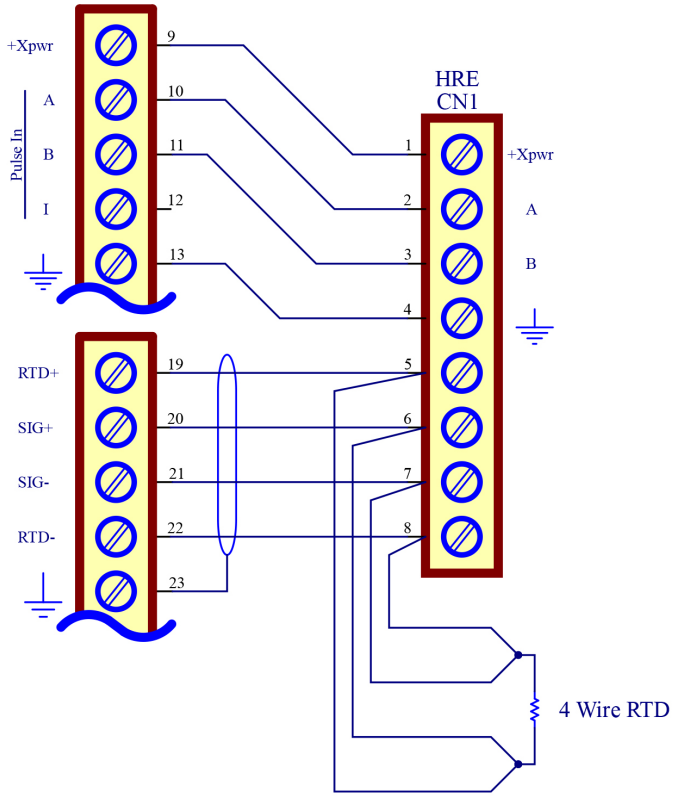
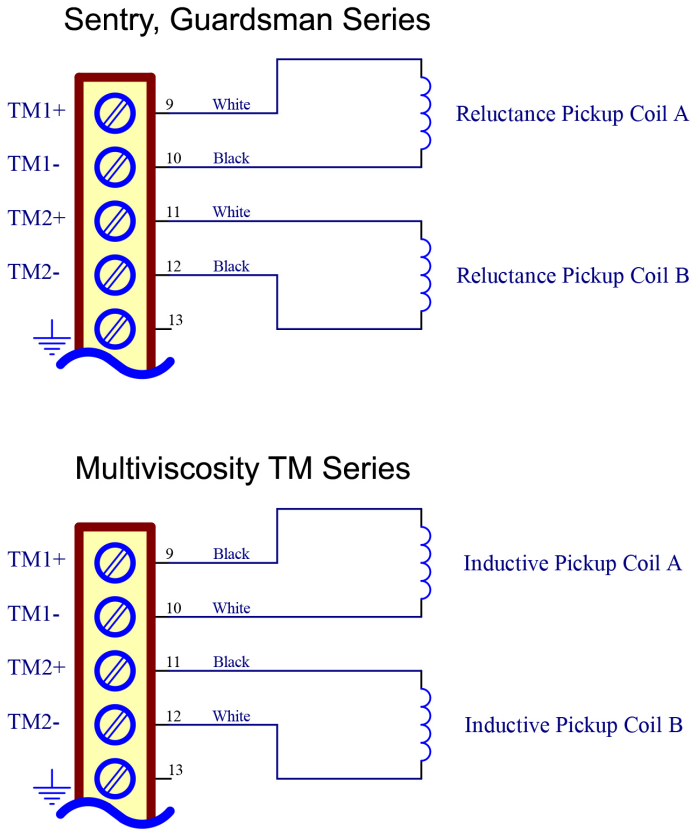


Figure 12: Wiring the NMT Directly to Pickup Coils in Sentry, Guardsman, and MV Turbine Meters



> The NMT contains a preamplifier not found in the NMB for low-voltage inputs. If pulse transmission to a SCADA system or flow computer is required for the application, the addition of a PA-6 is recommended.

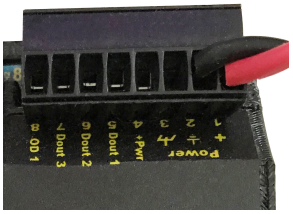
3.3 Finishing and Testing the Installation

3.3.1 Power Supply

The NMB requires a power source capable of providing 12 to 24 VDC and approximately 150 mA maximum load (not including any external DC load).

The first time you activate the NMB's power supply, the red LED light should begin blinking and the integrated display panel should provide details about the NMB.

Figure 13: Power Supply Inputs

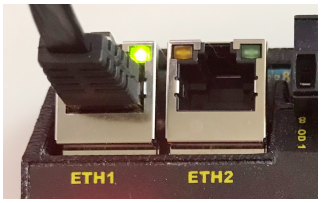


3.3.2 Network Connection

To connect your NMB to your Ethernet network, connect a Category (CAT) 5 or 6 Ethernet cable from either Ethernet port on your NMB to a suitable hub, network switch, router, or directly to a personal computer (PC). A second Ethernet port is available so you can include the NMB in a daisy chain network schema.

After your NMB has been successfully installed, powered up, and connected to your network, it is ready to be configured. For instructions, see Section 4: Monitoring and Configuring the NMB.

Figure 14: Network Input



4 Monitoring and Configuring the NMB

Once the NMB is installed and configured, it operates independently and should not need attention unless an alarm event is detected or the meter is serviced.

4.1 Remotely Accessing the NMB

Several methods are available for accessing data from the NMB, as follows:

- You can use a Web browser to view your NMB's current state of operation and configure the device.
- You can configure the NMB to communicate with a simple Supervisory Control and Data Acquisition (SCADA) system to alert an automation system of an alarm or other event, as well as to receive simple commands.
- You can configure the NMB to communicate directly with a Message Queuing Telemetry Transport (MQTT) protocol-compliant broker, allowing access to both the NMB's data and functionality by any MQTT client.

4.1.1 Accessing the NMB Using a Web Browser

You can use a Web browser to view your NMB's current state of operation and configure the device, as well as to reset alarms. Any computer on the same network should be able to communicate with the NMB.

4.1.1.1 Setting an Initial IP Address

The NMB's default network connection uses the Dynamic Host Configuration Protocol (DHCP). When you first set up your NMB, it requests an IP address from your network's DHCP server. If the request fails, the NMB reverts to the factory-default, static Class C Internet Protocol version 4 (IPv4) address of 192.168.1.8.

You can verify your current IP address using the NMB's integrated display panel.

Figure 15: Integrated Display Panel

After you have established a connection and can access the NMB's dashboard and configuration area, you can change its network settings (Section 4.3.7: Configuring Network Settings).

If the NMB's dashboard does not open, begin troubleshooting the issue using the following steps:

- Verify that the IP address, netmask, and gateway settings on the NMB's integrated display panel are valid for your network.
- Verify the host can access the NMB (for example, check routing or permissions) and that the NMB's replies are routable to the host.

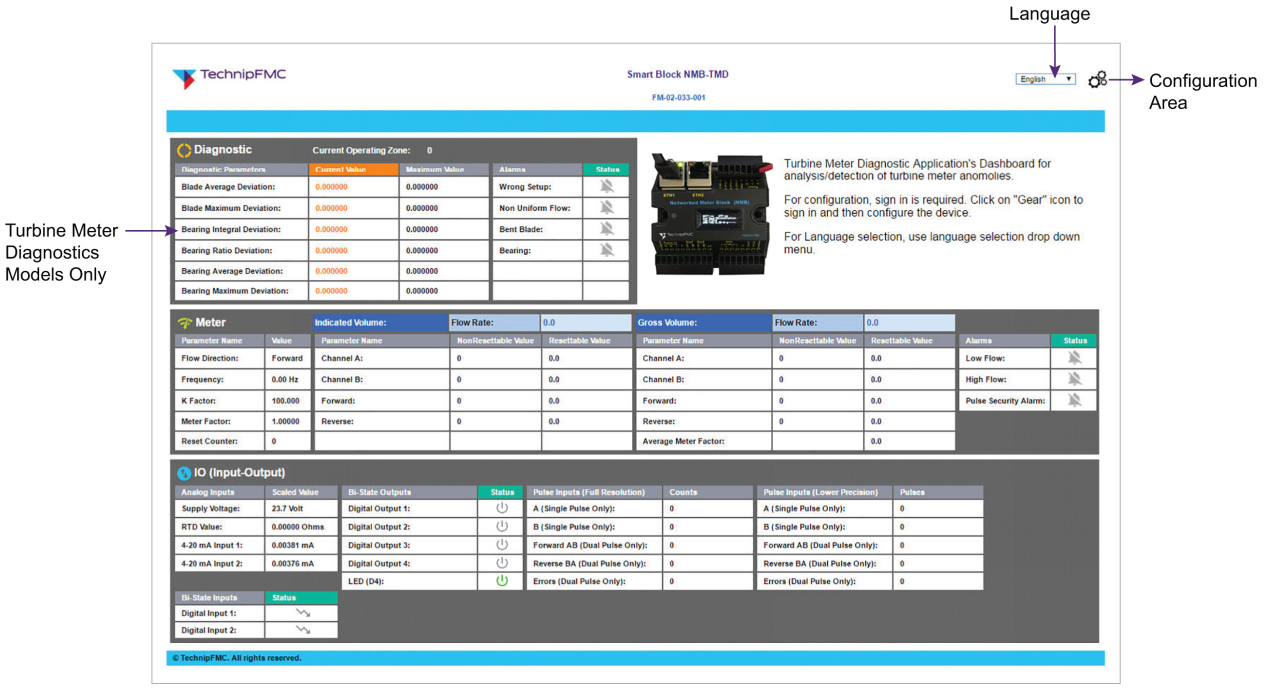
If you are still unable to launch the dashboard, contact your information technology (IT) department.

4.1.1.2 Launching the NMB Dashboard

Pointing your web browser to your NMB's IP address launches the NMB's dashboard, which displays an overview of its current state of operation.

The dashboard is accessible to anyone on your network. Those who need to configure the NMB or access additional information must log into the NMB's configuration area. For more information, see Section 4.3.1: Accessing the Configuration Area.

Figure 16: NMB Dashboard for NMB-TMD Firmware



4.1.2 Communicating with a PLC or SCADA System

The NMB uses functions that can be configured for unmanned, automated interaction with a Programmable Logic Controller (PLC) firmware system or SCADA software system—such as TechnipFMC's UCOS software—to control digital output. Likewise, input functions can be configured to be triggered via digital input (see Section 4.3.3.3: Configuring Basic Inputs and Outputs).

4.1.2.1 Digital Outputs

The NMB has a total of three digital output channels available (labeled Dout 1 through 3). Output #1 and Output #2 can be configured for any of the following functions; Output #3 is limited to the first three functions. See Section 4.3.3: Configuring Inputs and Outputs for details about configuring these digital functions.

- Off
- On
- MQTT controlled
- Pulse output to samplers
- Flow direction indication high is reversed
- Flow direction indication high is forward
- Pulse security alarm

- Low flow alarm
- High flow alarm
- Active turbine alarm (available when using the NMB-TMD firmware)
- Active general alarm
- Previous general alarm
- Alarm for wrong setup (available when using the NMB-TMD firmware)
- Alarm for bent blades (available when using the NMB-TMD firmware)
- Alarm for bearing (available when using the NMB-TMD firmware)

4.1.2.2 Digital Inputs

The NMB has two digital inputs (labeled Din1 and Din2). Each input can be configured for one of the following functions. See Section 4.3.3: Configuring Inputs and Outputs for details about configuring these digital functions.

- Not configured
- Flow direction
- Seal parameters
- Alarm acknowledgment

4.1.3 Communicating with an MQTT-Protocol Interface

After establishing a network connection for your NMB, you can configure a connection to an MQTT broker. The message broker can be privately maintained or cloud-based.

An MQTT broker is a third-party application that typically runs on an intranet or cloud-based server that enables authorized users to subscribe to information from data sources that publish information to the message broker. By publishing data to a message broker, the NMB enables one or more clients to monitor or act upon data from the NMB via the MQTT broker.

The NMB publishes data via multiple MQTT topics, which are logically divided into events, process variables, and configuration data classifications. The process variable and configuration information is further broken down into categories called data sets. These data sets are also available in both JavaScript Object Notation (JSON) and Extensible Markup Language (XML) formats for users. The schema associated with the JSON and XML data sets is also available directly from the NMB.

Topics are either published as they occur (such as events), on a configurable periodic basis (such as every 5 seconds), or only once (such as on power-up or initial connection).

A full list of topics, associated data structures, and process variables available for MQTT can be found in Appendix A: Data Reference for RESTful and MQTT Schemas.

To use the MQTT interface, you must configure details about the MQTT broker you want to use. For instructions, see Section 4.3.7.3: Configuring MQTT Server Settings.

4.2 Implementing Security

The NMB provides the following methods for securing configuration settings and data:

- Selecting Seal Parameters for a digital input and wiring the input to an external key switch; when the input is de-energized, changes to configuration settings are prevented by disabling the tabs in the

NMB web interface's configuration area (for instructions, see Section 4.3.3.3: Configuring Basic Inputs and Outputs)

- Physically sealing the NMB's instrument housing and applying a seal wire to prevent tampering
- Using TLS to validate a secure connection between the NMB and an MQTT server (for instructions see Section 4.3.7.3: Configuring MQTT Server Settings)

> Due to inherent vulnerabilities of potential malicious code in web browsers, Guidant is not responsible for erroneous information displayed in the NMB's web interface.

- Automatically logging out of the configuration area after 15 minutes of inactivity to prevent unauthorized personnel from accessing configuration settings

4.3 Configuring Your NMB

4.3.1 Accessing the Configuration Area

The configuration area enables you to set and change your NMB's configuration parameters, implement additional layers of security, access the Bootloader, and reboot the NMB. Anyone with network access to the NMB can connect to it using a Web browser and view current operating conditions; however, security credentials are needed to access the configuration area.

To log into the configuration area, complete the following steps:

1. In the upper right corner of the NMB's dashboard, click  . The Login pane opens.
   a. In the Username field, type your username. The factory default username is `smartblock`.
   b. In the Password field, type your password. The factory default password is `iodevice`.

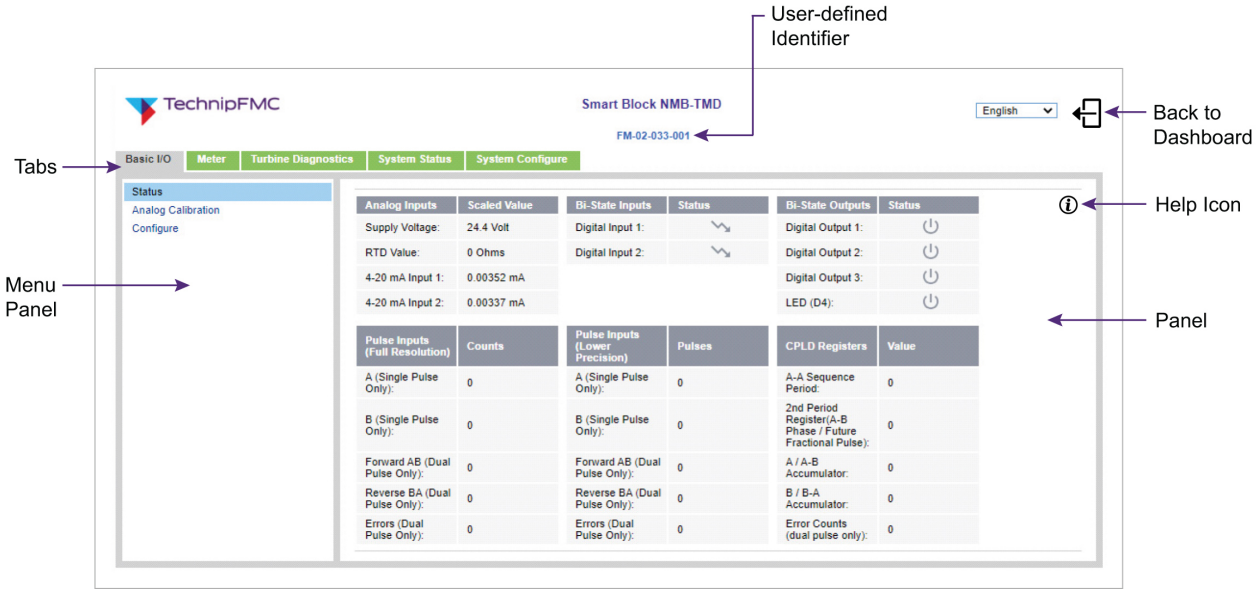
      > To ensure that only specific personnel on your network can access your NMB's configuration parameters, you should change the factory default username and password the first time you log in to the configuration area. For instructions on doing so, see Section 4.4.2: Changing Your NMB's Login Credentials.

   c. Click the Login button.

4.3.2 Navigating the Configuration Area

The NMB's configuration parameters and details are organized into tabs across the top and a menu pane on the left. When you click a tab and then select a menu option, the fields shown in the pane on the right change accordingly. Depending on whether you own model NMB or NMB-TMD, the menus available may change.

Figure 17: Configuration Area



Listed below are common icons in the configuration area:

- Takes you back to the dashboard and logs you off of the configuration area
- Indicates the output channel is de-asserted (off)
- Indicates the input or output channel is asserted (on)
- Indicates the alarm is not active
- Indicates the alarm is active
- Indicates the input channel is de-asserted (off)
- Indicates the input channel is asserted (on)
- Opens a pop-up window with field-level information

4.3.3 Configuring Inputs and Outputs

The Basic I/O tab enables you to view and configure I/O details for the NMB, including basic I/Os, analog calibration settings, MQTT message settings, and event log options.

4.3.3.1 Viewing I/O Statuses

To view the statuses of the NMB's I/Os, values of pulse inputs, and additional details select the Basic I/O tab > Status menu.

4.3.3.2 Calibrating Analog Inputs

You can reduce inherent errors in the transducer from communicated values for analog channels. To calibrate a new device (such as a pressure transmitter) or recalibrate existing devices attached to your NMB, complete the following steps:

> The NMB's analog inputs are configured at the factory, but you can perform your own calibration on site. At any time, you can revert to the factory-calibrated default values if needed (see Section 4.3.8: Restoring Factory-Default Configuration Parameters).

1. Select Basic I/O > Analog Calibration. The Scaled Value column displays real-time values for the NMB's power supply voltage, analog resistive temperature device (RTD) input channel, and analog current input channels.
2. After determining the calibration standard RTD values and connecting the standard to the RTD input of the device, complete the following steps in the RTO Value row:
   a. Adjust the calibration standard to 50 to 60 ohms.
   b. In the Span Count column, type the measured resistance value for Point 1 and then click P1.
   c. Adjust the calibration standard to 190 to 200 ohms.
   d. In the Span Count column, type the measured resistance value for Point 2 and then click P2.
   e. Click Calibrate. The RTD's gain and offset values are automatically updated and can be used to validate the accuracy and precision of the calibration.
   f. To save the newly calibrated gain and offset values, click Apply.
3. Complete the following steps in the 4-20 mA Input 1 row:
   a. Source a 3.5 to 5.4 mA signal into the +Iin1 input on the NMB.
   b. In the Span Count column, type the current value for Point 1 and then click P1.
   c. Source a 19.5 to 20.5 mA signal into the +Iin1 input on the NMB.
   d. In the Span Count column, type the current value for Point 2 and then click P2.
   e. Click Calibrate. Input 1's gain and offset values are automatically updated and can be used to validate the accuracy and precision of the calibration.
   f. To save the newly calibrated gain and offset values, click Apply.
4. Complete the following steps in the 4-20 mA Input 2 row:
   a. Source a 3.5 to 5.4 mA signal into the +Iin2 input on the NMB.
   b. In the Span Count column, type the current value for Point 1 and then click P1.
   c. Source a 19.5 to 20.5 mA signal into the +Iin2 input on the NMB.
   d. In the Span Count column, type the current value for Point 2 and then click P2.
   e. Click Calibrate. The 4-20 mA Input 2's gain and offset values are automatically updated and can be used to validate the accuracy and precision of the calibration.
   f. To save the newly calibrated gain and offset values, click Apply.

4.3.3.3 Configuring Basic Inputs and Outputs

The Basic I/O tab's Configure pane enables you to configure your NMB's inputs and outputs, adjust analog filtering, and specify MQTT message frame rates. The NMB is functional with the system default values, except when you are using dual pulse or dual turbine meter pickup transducers.

To configure your NMB's inputs, outputs, and other basic details, complete the following steps:

1. Select Basic I/O > Configure.
2. In the Pulse Input Mode field, select one of the following options:
    - Single—One pulse stream or turbine meter pickup is available.
    - Dual—Two pulse streams or turbine meter pickups are available, 90 degrees out of phase. This option should be selected when you are using dual transducers and need to detect flow direction.
3. The Moving Average for Analog Inputs section enables you to adjust the analog filtering values. Samples are taken approximate every 60 milliseconds (ms). To change one of these values, do any of the following steps:
    - In the RTD field, type the number of analog-to-digital converter (ADC) samples that should be averaged to calculate the resistance value.
    - In the 4-20 mA Input 1 field, type the number of ADC samples that should be averaged for the Iin1 input on the NMB, which is used to calculate the 4-20 mA value.
    - In the 4-20 mA Input 2 field, type the number of samples that should be averaged for the Iin2 input on the NMB, which is used to calculate the 4-20 mA value.
    - In the Pulse A Rate field, type the number of the A pulse input frequency samples that should be averaged, which is used to calculate the indicated volume (IV) flow rate.
4. The MQTT Message Settings section enables you to adjust how often the NMB sends new values to a MQTT broker. To change these values, do either of the following steps:
    - In the Frame Rate field, type the frequency (in seconds) at which new values should be sent to the MQTT broker.
    - In the Event Message Threshold field, type the minimum alarm severity level (see Table 4: Alarm Severity Levels) to be displayed in the Event Log. (For instructions on viewing the event log, see Section 4.3.6.3: Viewing Recent Alarms.)
5. The Digital Input/Output section enables you to configure the logic used to trigger input or send output. To change these settings, do any of the following steps:
    - In the Output #1, #2, and #3 fields, select one of the following functions to be used for each output. These fields correspond to the Dout1, Dout2, and Dout3 outputs on the NMB.

        > Output #3 is limited to the first three of the following functions.

        - Off—The digital output is always de-energized.
        - On—The digital output is always asserted.
        - MQTT Controlled—The state of the output should be controlled by the MQTT message broker. (See Appendix A: Data Reference for RESTful and MQTT Schemas for a description of the message and control.)

- Pulse Output to Samplers—The NMB is used to control a sampler and is connected to the sampler grab input. A pulse is generated on this output each time a sample is required.
- Flow Direction Indication High Is Reversed—The output is asserted (on) when the flow is in the reverse direction and off when the flow is in the forward direction.
- Flow Direction Indication High Is Forward—The output is asserted (on) when the flow is in the forward direction and off when the flow is in the reverse direction.
- Pulse Security Alarm—Sets the output to asserted (on) when a pulse security alarm is detected.
- Low Flow Alarm—The output is asserted (on) when the flow rate drops below the configured threshold.
- High Flow Alarm—The output is asserted (on) when the flow rate exceeds the configured alarm threshold.
- Active Turbine Alarm—The output is asserted (on) when a turbine meter alarm is detected (only available when using the TMD firmware).
- Active General Alarm—The output is asserted (on) when a general alarm is detected (only available when using the TMD firmware).
- Previous General Alarm—The output is asserted (on) when any previous alarm has not yet been acknowledged (only available when using the TMD firmware).
- Alarm for Wrong Setup—The output is asserted (on) when a configuration parameter is set incorrectly (only available when using the TMD firmware).
- Alarm for Bent Blades—The output is asserted (on) when a bent turbine meter blade is detected (only available when using the TMD firmware).
- Alarm for Bearing—The output is asserted (on) when a bad bearing or irregular flow is detected in the turbine meter (only available when using the TMD firmware).

- In the LED (D4) field, select one of the following display options for the red LED light on the front of the NMB:
  - Off—The light is always off.
  - On—The light is always on (when the NMB is connected to a power supply).
  - MQTT Controlled—The light is controlled by an MQTT message broker.
  - MQTT Connection Status—The light blinks when the NMB is successfully communicating with the MQTT broker.
- In the Input #1 and #2 fields, select one of the following functions to be used for each input. These field correspond to the Din1 and Din2 inputs on the NMB.
  - Not Configured—No action is taken.
  - Flow Direction—Determines whether the current flow is added to the forward or reverse totals. When this input is asserted (on), the flow is counted as forward; when the input is off, the flow is counted as reverse.
  - Seal Parameters—Prevents changes to configuration settings when this input is de-energized by disabling tabs in the configuration area.

- Alarm Acknowledgment—Causes alarms to be acknowledged when the signal on this input is asserted (on).

6. To save your changes, click the Apply button.

4.3.4 Configuring Meter Settings

The Meter tab enables you to configure basic information about the meter connected to the NMB. When this information is configured, rate and volume details are displayed in the dashboard when flow is present.

4.3.4.1 Viewing Meter Flow Rates & Alarms

To view the current status of the meter's process variables and alarms, select the Meter tab > Status menu.

To reset the dual-pulse error count, click the Reset button.

For instructions on resetting meter alarms, see Section 4.5.2: Resetting Alarms in the NMB's Web Interface.

4.3.4.2 Configuring General Meter Parameters

Complete the following steps to modify general details about the meter connected to the NMB:

1. Select the Meter tab > Configure menu.
2. To change general information about the meter, do any of the following steps:
   - In the Company Name field, type the name of your company.
   - In the Meter Location field, type the location of the meter.
   - In the Meter ID field, type the name or identification code of the meter.
3. Complete the following steps in the Metering section to provide details needed to communicate information to the NMB:
   a. In the K Factor field, type the number of pulses produced by the meter per unit volume of flow.
   b. In the Time Units drop-down list, select the unit of time to be used to calculate the flow rate. Options are:
      - Second
      - Minute
      - Hour
      - Day
   c. In the Volume Unit drop-down list, select the unit of volume to be used to calculate the flow rate. Options are:
      - GAL—Gallon
      - BBL—Barrel
      - FT3—Cubic feet
      - M3—Cubic meter
      - LIT—Liter

d. In the Minimum Flow Rate field, type the minimum flow rate for the meter in use. Note that this also specifies the minimum rate at which meter signature calculation should be done.

e. In the Maximum Flow Rate field, type the maximum flow rate at which the meter signature calculation should be done.

f. If you configured your NMB for dual pulse input mode (see Section 4.3.3.3: Configuring Basic Inputs and Outputs), the system automatically determines the flow direction. When the meter transitions between directions, some extraneous pulses may be generated. To ignore a fixed number of pulses during direction transitions, type the number of meter pulses to ignore in the Backlash Pulse field.

> The backlash pulse value is meter- and installation-dependent and is best left at zero unless a representative value has been established based on data from your specific site's installation.

g. If a digital output contact in the Basic I/O > Configure pane has been configured for Pulse Output to Samplers, complete the following steps to configure sample grabs:

   i. In the Sampler Pulse Output/Unit Volume field, type the number of pulses that are output per unit of measured volume in a sample. This controls the pace of sample grabs.

   ii. In the Sampler Pulse Output Width field, type the duration in milliseconds for each output pulse in a sample.

h. In the Low Flow Alarm Point field, type the flow rate at which the Low Flow alarm should be triggered.

i. In the High Flow Alarm Point field, type the flow rate at which the High Flow alarm should be triggered.

j. If your meter is configured for dual pulse streams (see Section 4.3.3.3: Configuring Basic Inputs and Outputs), complete the following steps:

   i. In the Dual Pulse Error Flow Rate Threshold field, type the flow rate below which the NMB should not perform dual-pulse error checking.

   ii. In the Dual Pulse Max Error Counts field, type the number of dual pulse errors allowed before a Pulse Security Alarm is triggered.

   iii. In the Dual Pulse Error Count Reset drop-down list, select one of the following methods for resetting the dual-pulse error count:

      - Manual Reset Only—Enables you to manually reset the dual-pulse error count. (For instructions, see Section 4.3.4.1: Viewing Meter Flow Rates & Alarms.)

      - Reset Hourly—Automatically resets the dual-pulse error count once an hour (for example, 2:00).

      - Reset Daily—Automatically resets the dual-pulse error count once a day, at midnight.

4. Click Apply to save your work.

4.3.4.3 Meter Linearization

You can enable the system to determine and apply the meter's flow rate-specific correction based on meter proving data. To do so, complete the following steps:

1. Select the Meter tab > Configure menu.
2. In the Flow Rate column, type the flow rate for at least one and up to 10 linearization points. The linearization points should be ordered beginning with the highest flow rate and ending with the lowest flow rate. These values are used to calculate the meter's instantaneous meter factor at the current flow rate for both forward and reverse flow directions.
3. In the Meter Factor column, type a correction factor for each linearization point for which you specified a flow rate.
4. Click Apply to save your work.

4.3.5 Configuring Turbine Meter Options

If you purchased an NMB model with Turbine Meter Diagnostic firmware (NMB-TMD) and it is connected to a properly installed and configured turbine meter, your NMB can generate a signature representing the baseline condition of the meter. This signature is relatively unaffected by the characteristics of the specific product flowing through the meter.

The turbine meter's signature (also referred to as a baseline characterization) is controlled by the following factors:

- The angle of the turbine meter's blade
- The spacing between blades (linearity)
- The bearing resistance in relation to rotational momentum (meter factor)
- Hydraulic flow characteristics (such as excessive pulsation, flashing, and swirl/repeatability)

The NMB monitors the blade-to-next-blade and blade-to-same-blade period ratio and calculates a standard deviation for each blade. Pulsation also can be detected by monitoring the time for a revolution and comparing it to the previous revolution.

The NMB also monitors the blade timing in real time and compares this to the turbine meter's signature. If the deviation is outside of its configured out-of-tolerance limits for longer than the specified sensitivity time, then an alarm is generated that identifies the most probable cause of the detected problems. This alarm is automatically reset when the turbine meter's signature is within its tolerance limits for longer than the sensitivity time.

You can view recent alarms in the NMB's alarm event log (see Section 4.3.6.3: Viewing Recent Alarms). You can periodically review the event log to prevent turbine meter problems from going undetected for long periods of time, as well as to establish preventative maintenance programs to increase the likelihood of trouble-free operation of your turbine meter.

4.3.5.1 Viewing the Turbine Meter Status

To view the current status of a turbine meter connected to your NMB, select the Turbine Diagnostics tab > Status menu.

You also can reset turbine meter diagnostic alarms in the Status tab (see Section 4.5.2: Resetting Alarms in the NMB's Web Interface).

4.3.5.2 Enabling Turbine Meter Diagnostics

Enabling turbine meter diagnostics in the NMB involves three basic steps:

- Defining flow zones in terms of flow rates
- Specifying known diagnostic signature characteristics or enabling the Turbine Meter Diagnostic feature to calculate it for you
- Maintaining flow within the flow rage defined for each zone for a period that is sufficient to learn the zone's characterization

When product flow through the meter begins, the NMB begins the sampling process. When a sufficient number of samples for a zone are collected, the current value meter flow characteristic is calculated.

To configure a turbine meter's diagnostic information, complete the following steps:

1. Select Turbine Diagnostics > Configure.
2. Specify general meter diagnostic details using the following steps:
    a. In the Diagnostic Mode drop-down list, select whether the NMB's turbine diagnostic functionality should be active. Options are:
        - Active—The Turbine Meter Diagnostic functionality is enabled and automatic diagnostic signature calculation and real-time meter diagnostics is occurring.
        - Inactive—The Turbine Meter Diagnostic functionality is inactive. When configuring a turbine meter, diagnostic functionality should be inactive.
    b. In the Diagnostic Zone field, select the basis for how the turbine meter's diagnostic signature should be calculated. Options are:
        - Manual—When selected, enables you to manually specify diagnostic signature information.
        - Auto—When selected, Turbine Meter Diagnostic functionality automatically calculates the diagnostic signature based on product flow in each zone.

            > The system indicates that automatic diagnostic signature calculations are finished by changing this field's selection to Manual.

        - Reset All Zones—Clears out data for all zones.
        - Reset Zone 1—Clears the data for Zone 1.
        - Reset Zone 2—Clears the data for Zone 2.
        - Reset Zone 3—Clears the data for Zone 3.
        - Reset Zone 4—Clears the data for Zone 4.
        - Reset Zone 5—Clears the data for Zone 5.
    c. In the Number of Blades field, type the actual number of blades or buttons in the turbine meter. This value must be correct for proper turbine meter diagnostic functionality.
    d. In the Alarm Sensitivity field, type the number of seconds that an alarm should be actively reported after the diagnostic alarm buffer of 30 seconds. For example, when an alarm occurs, it is not reset

until flow is within the turbine meter's tolerance limits for 30 seconds plus this defined sensitivity time.

e. In the Averaged Seconds field, type the number of seconds during which the NMB should average pulse timing data to smooth transient conditions and avoid nuisance alarms.

f. In the Turbine Error Tolerance % field, type the percentage of allowed deviation from the meter's diagnostic signature before alarms are generated.

3. The Zone section contains details about the range of flow rates. In the Flow Rate Threshold row, type the flow rate at which the turbine meter's signature changes. For example, in the Zone 1 field, type the flow rate threshold between zones 1 and 2; in the Zone 2 field, type the flow rate threshold between zones 2 and 3, and so on. (The high and low flow rates that define the boundaries of each diagnostic zone are set in the Minimum Flow Rate and Maximum Flow Rate fields in Meter > Configuration.)

   The deviation values in this section represent the diagnostic signature of the turbine meter.

4. Click Apply to save your changes.

4.3.5.3 Re-Characterizing a Turbine Meter's Signature

When a turbine meter's signature no longer represents the meter's behavior, such as when a rotor is replaced or hydraulic changes are made, you can re-calculate one or more zones to update the meter's signature. To do so, complete the following steps:

1. Select Turbine Diagnostics > Configure.
2. In the Diagnostic Zone field, select the zones you want to reset.
3. Click Apply to perform the reset.
4. In the Diagnostic Zone field, select Auto to enable the device to calculate the new diagnostic signature.
5. Click Apply to save your changes.

4.3.6 Viewing System Status Details

The System Status tab enables you to view status information and other details about the NMB system.

4.3.6.1 Viewing OLED Display Panel Information

To remotely view the information displayed on your NMB's integrated display panel, such as the version number, status, and IPv4 address, select the System Status tab > Messages menu.

4.3.6.2 Adding Custom Messages to the OLED Display Panel

You can add custom messages to your NMB's integrated display panel. For example, you can display a two-line message stating:

```
For customer support
call +1 814.898.5000.
```

To display custom messages on your NMB's integrated display panel, complete the following steps:

1. Select System Status > Messages.

2. In the Communication Message #1 field, type a message to display of up to 21 characters (including spaces).
3. In the Communication Message #2 field, type a second message or the second line of two-line message, up to 21 characters.
4. Click Apply to save your changes.

4.3.6.3 Viewing Recent Alarms

The event log provides information about the 20 most recent global and alarm events for the NMB, including the date and time, severity level, and a description of the alarm event.

To view the event log, select System Status > Event Log.

For a list of alarm types, see Table 3: List of Alarms.

4.3.6.4 Viewing Server Connections

You can view both MQTT and NTP connection information in by selecting System Status > Server Connections.

4.3.6.5 Viewing Hardware Information

You can view the NMB's serial number by selecting System Status > Hardware Information.

4.3.6.6 Viewing Firmware Information

You can view details about the NMB's firmware by selecting System Status > About.

4.3.7 Configuring Network Settings

4.3.7.1 Changing Your NMB's IP Address

When you first set up your NMB, it requests an IP address from a DHCP server. If a DHCP server is not available or the request fails, the NMB reverts to the factory default IP address displayed on the integrated screen. After you have established a connection and can access the NMB's dashboard and configuration area, you can change its network settings.

To change your NMB's IP address, complete the following steps:

1. Select System Configure > IPv4.
2. In the Preferred IP Address Method field, select one of the following methods to use to connect to your NMB:
   - Static—Connects to your network using a static IP address, subnet mask, and default gateway

     > When you use a static IP address for the NMB, you may need to change the computer's IP address so that both devices are assigned addresses on the same logical network (for instructions, refer to Microsoft).

   - DHCP—Requests an IP address, subnet mask, and default gateway from a DHCP server on the connected network (default)

- AutoIP—Uses a link-local addressing technique to determine the IP address to use on the Ethernet

3. If you selected Static as your preferred IP address method, complete the following steps:

   a. In the IP Address field, type the IP address you want to use for your NMB.

   b. In the Subnet Mask field, type the subnet mask for the specified IP address.

   c. In the Default Gateway field, type the address of your network's default gateway.

   > If the specified IP address and default gateway are mismatched, the Default Gateway will display `0.0.0.0`.

4. Click Apply to save your changes.

4.3.7.2 Configuring NPT Server Settings

By default, three Network Time Protocol (NTP) servers are configured to synchronize the NMB's clock. However, you can change the servers to suit your location using the following steps:

1. Select System Configure > Servers.

2. For each server you want to access for clock synchronization, complete the following steps in the NTP Server Settings section:

   a. In the IP Address column, type the IP address of the domain's NTP server.

   b. In the Connection Timeout column, type the number of seconds the NMB should wait for a connection to the NTP server before trying the next one. The default connection timeout is 300 seconds (5 minutes).

3. Click Apply to save your changes.

4.3.7.3 Configuring MQTT Server Settings

You can configure Message Queuing Telemetry Transport (MQTT) protocol settings to transport messages between the NMB and an MQTT broker. To do so, complete the following steps:

1. Select System Configure > Servers.

2. Locate the MQTT Broker Settings section.

3. In the IP Address field, type the message broker's IP address or URL.

4. In the Port Number field, type the message broker's Ethernet port number.

5. In the Authentication Name field, type the name used to authenticate the connection between the NMB and the message broker.

6. In the Password field, type the password used to authenticate the connection between the NMB and the message broker.

7. In the Connection Timeout field, type the number of seconds the NMB should wait before indicating that the MQTT server is not available. (The NMB will continue trying to connect to the server.) This field defaults to 300 seconds (5 minutes).

8. In the Keep Alive Interval field, type the number of seconds the connection between the NMB and the message broker can be idle before verifying the integrity of the connection. This field defaults to 300 seconds (5 minutes).

9. In the System Name field, type a name for the MQTT-enabled devices represented as a system, such as a site name or asset group.

10. In the Object Tag field, type a name for the MQTT client ID for the NMB that is unique within the system.

> Each NMB in the system should have a unique object tag; duplicate tags could result in the MQTT broker rejecting connection requests or terminating a connection to accommodate a new request.

11. If the Transport Layer Security (TLS) cryptographic protocol should be used to validate the communication link between the NMB and the message broker and encrypt message data, select the TLS Enable check box.

12. If the MQTT broker being used does not support data retention, select the Retain Flag Disable check box.

13. Click Apply to save your changes.

4.3.7.4 Adding an Instrument Tag

You can customize the name of your NMB that is displayed at the top of your screen when accessing the NMB via a Web browser. To do so, complete the following steps:

1. Select System Configure > Instrument Tag.

2. In the Instrument Tag field, type a name for the NMB that is unique within the MQTT domain.

3. Click Apply to save your changes.

4.3.8 Restoring Factory-Default Configuration Parameters

You can restore your NMB's configuration settings to the factory default settings; however, this feature should be used with caution. We recommend first exporting your current configuration settings before resetting them (for instructions, see Section 4.3.10: Backing Up Your Configuration Settings).

To reset your NMB to its factory default settings, complete the following steps:

1. Log into the configuration area.

2. Select System Configure > Utilities.

3. Click the Reset button.

4. When prompted, click OK.

4.3.9 Rebooting the NMB

You can reboot your NMB when needed. To do so, complete the following steps:

1. Log into the configuration area.

2. Select System Configure > Utilities.

3. Click the Reboot button.
4. When prompted, click OK.

4.3.10 Backing Up Your Configuration Settings

You can save your configuration settings for future reference, as a backup, or as a template or clone. To do so, complete the following steps:

1. Log into the configuration area.
2. Select System Configure > Utilities.
3. In the Export area's field, type an name for the export file. The filename can use alphanumeric characters, hyphens, and underscores, but not spaces. (Do not include a file extension.)
4. Click the Export button.
5. The file will be saved as a JavaScript Object Notation (JSON) file directly to your user downloads folder on your C drive (C:\\Users*name*\Downloads).

4.3.11 Restoring Your Configuration from a Backup

If you previously exported your configuration settings into a backup file, you can overwrite your current configuration setting with the backed up settings. To do so, complete the following steps:

1. Log into the configuration area.
2. Select System Configure > Utilities.
3. In the Import Configuration Settings section, click the Choose File button.
4. Select your backup file. (By default, files are exported directly to your user downloads folder on your C drive (C:\\Users*name*\Downloads).)
5. Click the Import button.
6. When prompted, click OK.

4.4 Using the Bootloader

The Bootloader enables you to configure settings that can only be changed when the NMB is offline and all outputs are de-energized. In the Bootloader area, you can change the login credentials, update the NMB's firmware, upload custom TLS certificates, and configure factory-only fields for testing and the initial configuration of the NMB.

> **CAUTION:** Launching the Bootloader during system operations can cause hazardous conditions. Launching the Bootloader ceases the NMB's monitoring functionality and de-energizes all outputs.

4.4.1 Launching the Bootloader

To launch the Bootloader, complete the following steps:

1. In the NMB's dashboard, click  . The Login pane opens.
2. Enter your login credentials and then click Login. The configuration area opens.
3. Select System Configure > Utilities and then click the Launch button.

> Launching the Bootloader ceases the NMB's monitoring functionality and de-energizes all outputs.

4. In the Login pane, enter your login credentials again and then click Login. The Bootloader area opens.

4.4.2 Changing Your NMB's Login Credentials

When shipped from the factory, the NMB is configured with generic login credentials. At a minimum, it is recommended that you change these login credentials the first time you log into the NMB to improve your network security.

> It is important to set a strong password; this password protects uploaded certificates and private keys.

To change your NMB's login credentials, complete the following steps:

1. In the NMB's dashboard, click  . The Login pane opens.
2. Enter your current login credentials and then click Login. The configuration area opens.
3. Select System Configure > Utilities and then click the Launch button.

> Launching the Bootloader ceases the NMB's monitoring functionality and de-energizes all outputs.

4. In the Login pane, click the Change Credentials button.
5. To change the username, complete the following steps:
   a. In the Current Username field, type the NMB's current username.
   b. In the New Username, type the username you want to use. Usernames must be at least eight characters and cannot include spaces.
   c. In the Confirm Username, type your new username again.
6. To change the password, complete the following steps:
   a. In the Current Password field, type the NMB's current password.
   b. In the New Password field, type the password you want to use. Passwords must contain:
      - At least eight characters
      - At least one uppercase letter
      - At least one lowercase letter
      - At least one number
      - At least one special character (!, @, $, %, or *)
   c. In the Confirm Password field, type your new password again.

7. Click Change.
8. Re-launch the NMB firmware.

> It is important to properly exit the Bootloader and re-launch the NMB firmware (see below) so that the NMB can return to operating normally.

4.4.3 Viewing Security Certificates

Unique factory-supplied security certificates are included with each NMB. You also can upload site-specific certificates.

Three certificates are available in the NMB:

- Server certificate, which is used for the on-board web server
- Client certificate, which is used for the MQTT client
- Certificate Authority (CA) certificate, which is used to authenticate communication with the NMB when access to an external network is not available

To view your NMB's security certificates, complete the following steps:

1. Launch the Bootloader.

   > Launching the Bootloader ceases the NMB's monitoring functionality and de-energizes all outputs.

2. Select System Configure > TLS Certificate
3. When you finish viewing certificates, exit the Bootloader area and re-launch the NMB firmware.

> It is important to properly exit the Bootloader and re-launch the NMB or TMD firmware so that the NMB can return to operating normally. Closing your web browser without first properly exiting the Bootloader lengthens the time that your NMB is functionally disabled.

4.4.4 Updating Your NMB's Firmware

To take advantage of enhancements and bug fixes to the NMB, you can update its firmware on site.

To install a firmware update, complete the following steps:

1. Launch the Bootloader.

   > Launching the Bootloader ceases the NMB's monitoring functionality and de-energizes all outputs.

2. Select System Configure > Firmware Update.
3. Click the Choose File button and then select the new firmware image file (*.app) provided by Guidant on your local machine. Only valid, digitally signed application images from Guidant may be installed.
4. Click the Load button to upload the file to the NMB.

5. When the upload status indicates that the transfer was successful, exit the Bootloader area and re-launch the NMB firmware.

> It is important to properly exit the Bootloader and re-launch the NMB or TMD firmware so that the NMB can return to operating normally. Closing your web browser without first properly exiting the Bootloader lengthens the time that your NMB is functionally disabled.

4.4.5 Re-Launching the NMB Firmware and Exiting the Bootloader

It is important to properly exit the Bootloader by re-launching the NMB firmware so that the NMB can return to operating normally. Closing your web browser without first properly exiting the Bootloader lengthens the time that your NMB is functionally disabled. To exit the Bootloader area and return to the NMB firmware, complete the following steps:

1. Select System Configure > Utilities.
2. Click the Launch button to launch the NMB firmware, return to the dashboard, and return the NMB to its as-configured output state.

4.5 Monitoring and Resetting Alarms

Basic I/O and meter alarms are generated when operating values are outside the thresholds of configured limits and when certain conditions are detected, such as a failed transducer. To generate TMD alarms, the characterization of at least one operating zone is required.

When an alarm is generated, you may be required to correct the underlying issue before resetting the alarm. After the issue is corrected, multiple methods are available for resetting the alarm.

4.5.1 Alarm Generation

Alarms are generated in both the meter layer and the turbine diagnostic layer. To generate TMD alarms, the characterization of at least one diagnostic zone must be completed and the diagnostic must be enabled (see Section 4.3.5.2: Enabling Turbine Meter Diagnostics) before any TMD alarm conditions can be detected.

In the NMB's web interface, you can view the status of alarms, identified by the following icons:

-  Indicates an inactive alarm
-  Indicates an active alarm

4.5.1.1 Alarm Types

The NMB provides the following types of meter alarms. Each alarm can be manually reset in the NMB's web interface, as well as via MQTT or a digital input.

Table 3: List of Alarms

Alarm Name	Meaning	Location in Web Interface
	All Meters	
Pulse Security Alarm	The NMB detects missing pulses in the meter's pulse sequence when Pulse Input Mode is set to Dual. The NMB identifies an error in the A-B or B-A pulse sequencing indicative of hardware or wiring failure.	Dashboard and Meter > Status
Low Flow	The calculated flow rate is below the meter's configured minimum flow rate.	Dashboard and Meter > Status
High Flow	A batch's instantaneous flow rate is greater than the meter's configured maximum flow rate.	Dashboard and Meter > Status
	Turbine Meters	
Wrong Setup	A configuration parameter for the turbine meter is improperly set and the NMB cannot function as configured.	Turbine Diagnostics > Status
Bent Blade	The calculated blade average deviation percentage is greater than the turbine meter's configured maximum value and the calculated blade maximum deviation percentage is greater than the turbine meter's configured maximum value.	Turbine Diagnostics > Status
Non-Uniform Flow	The calculated bearing average deviation percentage is greater than the turbine meter's configured maximum value and the calculated bearing maximum deviation percentage is greater than the turbine meter's maximum or the calculated consistency integral (Integral Deviation %) is greater than the entered maximum error value for consistency integral.	Turbine Diagnostics > Status
Bearing	The calculated bearing ratio deviation percentage is greater than the turbine meter's configured maximum.	Turbine Diagnostics > Status

4.5.1.2 Alarm Severity

The NMB provides five severity levels for meter alarms, level 1 being the most serious and level 3 being the least. The following table provides a description of each severity level:

Table 4: Alarm Severity Levels

Level	Description
1	Complete outage or degradation so severe that core functionality is unusable
2	Functional degradation for a subset of members or a loss of some core functionality for all members
3	Noticeable degradation or loss of minor functionality
4	Loss of redundancy or capacity; no member-visible impact
5	Any other minor issues

4.5.2 Resetting Alarms in the NMB's Web Interface

In the NMB web interface's configuration area, each alarm displays  or  for the both the alarm buffer and the alarm latch. The alarm latch indicates that the alarm's condition occurred and must be manually reset, even if the meter's operation has since returned to be within acceptable ranges. An alarm remains latched until you acknowledge it, regardless of whether the meter has returned to working within normal thresholds.

4.5.2.1 Resetting All Latched Alarms at Once

The NMB-TMD firmware provides an option to reset all latched alarms at the same time. To do so, complete the following steps:

1. Log into the configuration area.
2. Select Turbine Diagnostics > Status.
3. Next to Global Reset for All Alarms, click the Reset button.

4.5.2.2 Resetting Alarms

To reset an alarm, complete the following steps:

> To manually reset the Pulse Security alarm, a digital input must be configured to allow this. Otherwise, this alarm is automatically reset hourly or daily. For details, see Section 4.3.3.3: Configuring Basic Inputs and Outputs.

1. Log into the configuration area.
2. Ensure that the alarm condition is configured appropriately to avoid spurious alarms.
3. Locate the alarm that occurred (see Table 3: List of Alarms).
4. Wait for the alarm buffer icon to turn grey.

   > When you manually reset the Pulse Security alarm, you can reset the alarm when the alarm buffer icon is grey.

5. Click the Reset button to reset the alarm.

4.5.3 Resetting Alarms via MQTT

To reset alarms in the NMB using an MQTT broker, the Meter Commands topic provides alarm clearing functionality. This topic can be used by publishing a message with the clear alarm command field for the associated alarm set to a value of 1. See the Appendix A for more information.

4.5.4 Resetting Alarms via Digital Input

You can configure a digital input to acknowledge alarms. For instructions, see Section 4.3.3.3: Configuring Basic Inputs and Outputs.

5 Maintenance

Very little maintenance is required for the NMB. The only user-serviceable items on the NMB are the battery and the pluggable connectors.

> All fuses on the NMB are soldered onto the PC board and are thus not replaceable.

5.1 Replacing the Clock Battery

The NMB has a battery that powers a real-time clock used for time stamping log entries. The life of the battery can vary due to operating conditions, particularly the amount of time the NMB is left in a powered-off state.

When the NMB is in service, it is recommended that the battery be replaced at a minimum of 5-year intervals. If the NMB has been powered down for extended periods, it is recommended to replace the battery prior to putting the NMB back in service.

> The NMB must be removed from its explosion-proof instrument housing (if equipped) or its mounted position to replace the battery.
>
> It is imperative that the battery replacement is done in a safe area or an area that is known to be non-hazardous.

The following items are needed when replacing the NMB's battery:

- A new CR1220 coin cell battery

  > The battery must be manufactured by Panasonic, Maxell, Varta, or Renata, or supplied directly from Guidant (part number P8000017080). To maintain Ex certifications, substitutions are not allowed.

- A P1 Phillips head screwdriver

To replace the NMB's battery, complete the following steps (see photo in Figure 18: DIP Switches for reference):

1. Remove the NMB's power supply.
2. Ensure the area you are working in is non-hazardous (safe from combustible gases).
3. Open the instrument housing (if equipped).
4. Unplug the three pluggable connectors and ETH1 and ETH2. Make sure that cables are marked so they can easily be correctly reconnected.
5. Remove the NMB from its instrument housing or mounting position.
6. On the back of the NMB, loosen the three screws until you can easily lift off the back cover.
7. Remove the battery from its holder and replace it with the new battery (see the list of acceptable replacement batteries above).

8. Securely reattach the back cover of the NMB with the three screws.
9. Re-mount the NMB back to its original position and restore the removed cables to the same positions.
10. Restore power to the NMB. The time will automatically be set from the NTP servers (see Section 2.2: Real-Time Clock Synchronization).

6 Troubleshooting

If you have issues with a lost password, need to reset certificates, force a network configuration, or erase the application, you can use the DIP switches located on the back side of the NMB, next to the battery board.

Figure 18: DIP Switches

The Bootloader reads the individual switches at Power ON and takes the appropriate action. The following table provides details about using these DIP switches.

> DIP switches SW-3 and SW-4 currently do not have assigned actions.

Table 5: DIP Switch Actions

SW-1	SW-2	Action
ON	ON	Bootloader proceeds with loading the application
ON	OFF	Continue with Bootloader UI with fixed IP address 169.254.165.11 and subnet mask 255.255.0.0
OFF	ON	Bootloader resets the password and certificates
OFF	OFF	Bootloader erases the application and the date stored on MRAM

Appendix A: Data Reference for RESTful and MQTT Schemas

The following files are available in the RESTful interface to access data from the NMB over the network. Data can be requested in either JSON or XML format. Note that the same JSON data structures used for access via HTTP also are used for the MQTT topics for consistency. The JSON schema also are available directly from the NMB. Lists of the available files are provided below.

A.1 Schemas Defining Content of JSON/XML Data Structures

- https://<ip-addr>/global_discover/discover/json-schema
- https://<ip-addr>/global_event/event/json-schema
- https://<ip-addr>/global_pv/io/json-schema
- https://<ip-addr>/global_pv/io-status/json-schema
- https://<ip-addr>/global_pv/meter/json-schema
- https://<ip-addr>/global_pv/diag/json-schema
- https://<ip-addr>/global_param/io-config/json-schema
- https://<ip-addr>/global_param/io-cal/json-schema
- https://<ip-addr>/global_param/io-mode/json-schema
- https://<ip-addr>/global_param/meter-config/json-schema
- https://<ip-addr>/global_param/diag/json-schema

A.2 JSON-Formatted Data Structures

- https://<ip-addr>/global_discover/discover/json
- https://<ip-addr>/global_discover/hw-info/json
- https://<ip-addr>/global_pv/io-status/json
- https://<ip-addr>/global_pv/io/json
- https://<ip-addr>/global_pv/io-rawpulse/json
- https://<ip-addr>/global_pv/meter/json
- https://<ip-addr>/global_pv/diag/json
- https://<ip-addr>/global_param/io-config/json
- https://<ip-addr>/global_param/io-cal/json
- https://<ip-addr>/global_param/io-mode/json
- https://<ip-addr>/global_param/meter-config/json
- ttps://<ip-addr>/global_param/diag/json

A.3 XML-Formatted Data Structures

- https://<ip-addr>/global_discover/discover/xml
- https://<ip-addr>/global_discover/hw-info/xml
- https://<ip-addr>/global_pv/io/xml
- https://<ip-addr>/global_pv/io-status/xml
- https://<ip-addr>/global_pv/io-rawpulse/xml
- https://<ip-addr>/global_pv/meter/xml
- https://<ip-addr>/global_pv/diag/xml
- https://<ip-addr>/global_param/io-config/xml
- https://<ip-addr>/global_param/io-cal/xml
- https://<ip-addr>/global_param/io-mode/xml
- https://<ip-addr>/global_param/meter-config/xml
- https://<ip-addr>/global_param/diag/xml

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USA Operation
1602 Wagner Avenue
Erie, Pennsylvania 16510 USA
P:+1 814.898.5000

Germany Operation
Smith Meter GmbH
Regentstrasse 1
25474 Ellerbek, Germany
P:+49 4101 304.0