WirelessHART Field Field Network Manager Product Brief
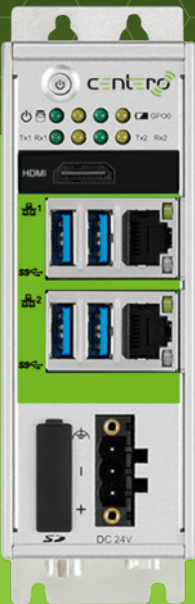
PRODUCT OVERVIEW – Centero's INTREPID Wireless Field Network Manager (WFNM) is a WirelessHART (IEC 62591) compliant Gateway. It provides wireless connectivity, network and security management to WirelessHART mesh field instrument networks. It also includes native support for SafeHART™ and is suitable for safety applications. It is suitable for installation in control rooms or cabinets, but also includes multiple remote antenna options for field wireless connectivity in both non-hazardous and hazardous areas. The WirelessHART™ (IEC 62591) industrial IoT standard provides a robust wireless protocol for the process measurement, control, safety and asset management applications. Based on the proven and familiar HART™ protocol, it enables users to gain the benefits of wireless technology while maintaining compatibility with existing devices, tools, and systems. Deploy highly scalable networks that cover large geographic areas due to the market leading wireless range of Centero's WiHART2 embedded wireless transceiver. Monitor, configure and manage field instruments via an intuitive web-based application and access both process values and diagnostics through MODBUS/TCP and HART-IP plant network interfaces.

PRODUCT HIGHLIGHTS

FEATURE	BENEFIT
Wireless Field Network Manager (WFNM)	Provides wireless field connectivity, network and security management to WirelessHART instruments.
SafeHART™ Compliant	Supports both traditional and SafeHART™ compliant WirelessHART field instruments.
Wireless Field Connectivity	Wireless field network connectivity with remote antenna options for both non-hazardous and hazardous areas.
Form Factor	Compact, suitable for installation in control rooms or cabinets
Highly Scalable WirelessHART Deployments	Reduce CAPEX through highly scalable deployments of up to 250 field instruments per Gateway.

PRODUCT HIGHLIGHTS (continued)

FEATURE	BENEFIT
Wide Range of Process Burst Rates	Process data burst rates ranging from 500 ms to several hours meet the requirements for a wide variety of use cases for field instruments engaged in both control and monitoring.
HART-IP and MODBUS/TCP Plant Connectivity	Monitor, configure and control field instruments via the Gateway from a wide gamut of plant network or cloud-hosted applications through HART-IP or MODBUS/TCP high-side interfaces.
Over-the-Air Upgrades	Supports Over-the-Air upgrades for field instruments.
Large File Transfers	Secure and reliable transfer of large files collected by field instruments engaged in condition, vibration or corrosion monitoring.
Security	Supports two-layered WirelessHART authentication, AES-128 encryption and SSL/HTTPS certificate-based Gateway access.
Health Diagnostics	Easily assess real-time health of assets deployed by accessing both field instrument and network diagnostics.
Remote Upgrade Capability	All Gateway software and firmware entities can be upgraded remotely via an AES-256 secure encrypted and authenticated process.

Meet the INTREPID Family of Products

The INTREPID WirelessHART product family includes various Field Gateway and Wireless Field Network Manager (WFNM) models depending on the wireless connectivity desired (WirelessHART and Wi-Fi MESH+) and type of area where the equipment will be installed (hazardous or non-hazardous areas).

MODEL	DESCRIPTION
NIO200HAG Line	Field Wireless Gateways – certified for operation in C1D2/ATEX rated hazardous areas or non-hazardous areas, optional Wi-Fi MESH+ wireless connectivity.
WFNM Line	Field Wireless Network Managers – small form factor appliances, wireless field connectivity for hazardous and non-hazardous areas.

INTREPID Management and Control Application

The INTREPID WFNM hosts a feature rich, user friendly and intuitive application. The INTREPID Management and Control application is web-based and allows users to easily connect, control, manage, and monitor WirelessHART field instruments engaged in various applications such as process automation monitoring and control, condition monitoring, steam trap and relief valve monitoring, gas monitoring and safety applications, valve control and monitoring, predictive maintenance, corrosion monitoring and many other. The INTREPID application allows users to visualize process data, diagnostics, alerts and alarms as well as manage and configure all aspects of the WirelessHART field instruments and network.

INTREPID Management and Control Application (continued)
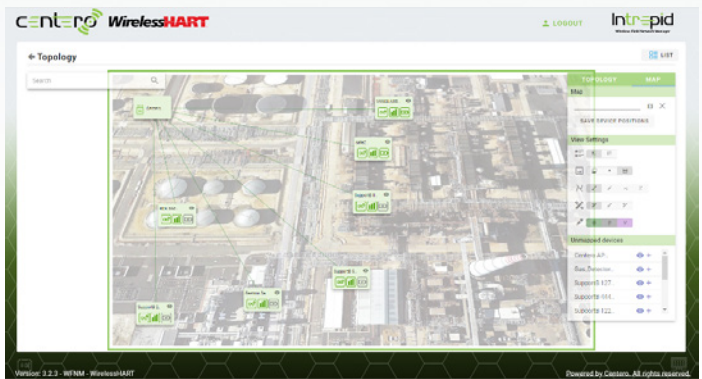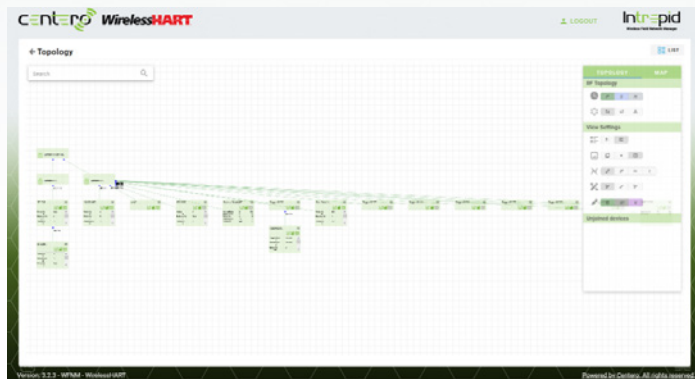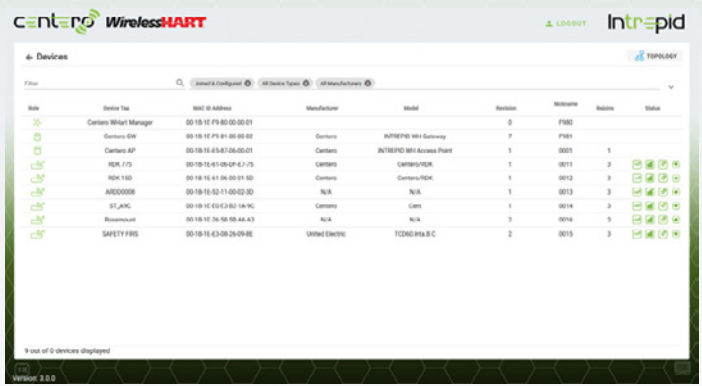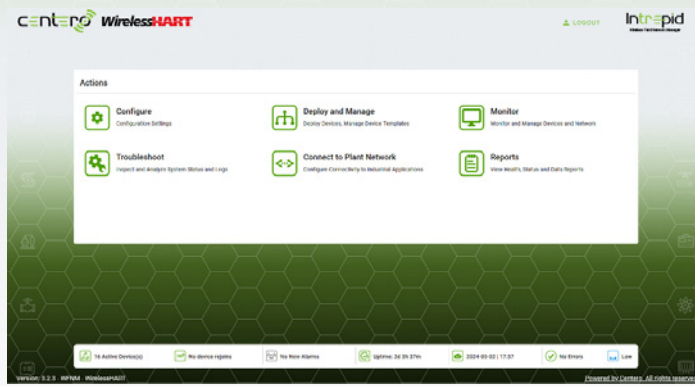
WirelessHART™ Field Connectivity Options

The INTREPID WFNM provides wireless field connectivity to WirelessHART™ field instruments. It is offered with various wireless connectivity options for both hazardous and non-hazardous areas. The INTREPID WFNM can be installed in control rooms or cabinets. Wireless field connectivity is provided through remote antennas that are connected via RF extension cables of various lengths.

| Antenna	Field Wireless Connectivity	Area Type
	Direct mount omni-directional antenna suitable for indoor deployments. This is the default antenna shipped with the INTREPID WFNM.	Non-hazardous – indoor antenna.
	Remote, rugged, omni-directional antenna suitable for deployments in hazardous areas. Can be wall or pole mounted.	Hazardous ATEX Zone 1 or Zone 2 areas – outdoor antenna.
	Remote, rugged, high-gain, omni-directional antenna suitable for deployments in harsh locations. Can be wall or pole mounted.	Harsh locations – outdoor antenna.

Support for SafeHART™

Safety use cases must meet rigorous requirements and performance criteria that exceed those for traditional wireless process automation use cases. The INTREPID WFNM meets strict requirements for functional safety in mission critical applications such as data reporting under strict timing requirements and data availability.

Strict reliability and timeliness requirements need additional mechanisms that ensure data packets arrive at the designated destination within a well-defined timeout window. The SafeHART™ safety protocol builds on the widely deployed HART, WirelessHART and HART-IP standard and enables safe digital communications

between field instruments and safety instrumented systems. It is based on a digital layer safety protocol that enables vendors to offer HART/WirelessHART SIL2 and SIL3 capable and certified field instruments.

The INTREPID WFNM supports both traditional as well as SafeHART™ compliant WirelessHART field instruments. It supports mesh network bandwidth allocation tailored to SafeHART™ instruments to meet safety requirements. The INTREPID Management and Control Application also allows users to visualize and interact with SafeHART™ compliant WirelessHART field instruments.
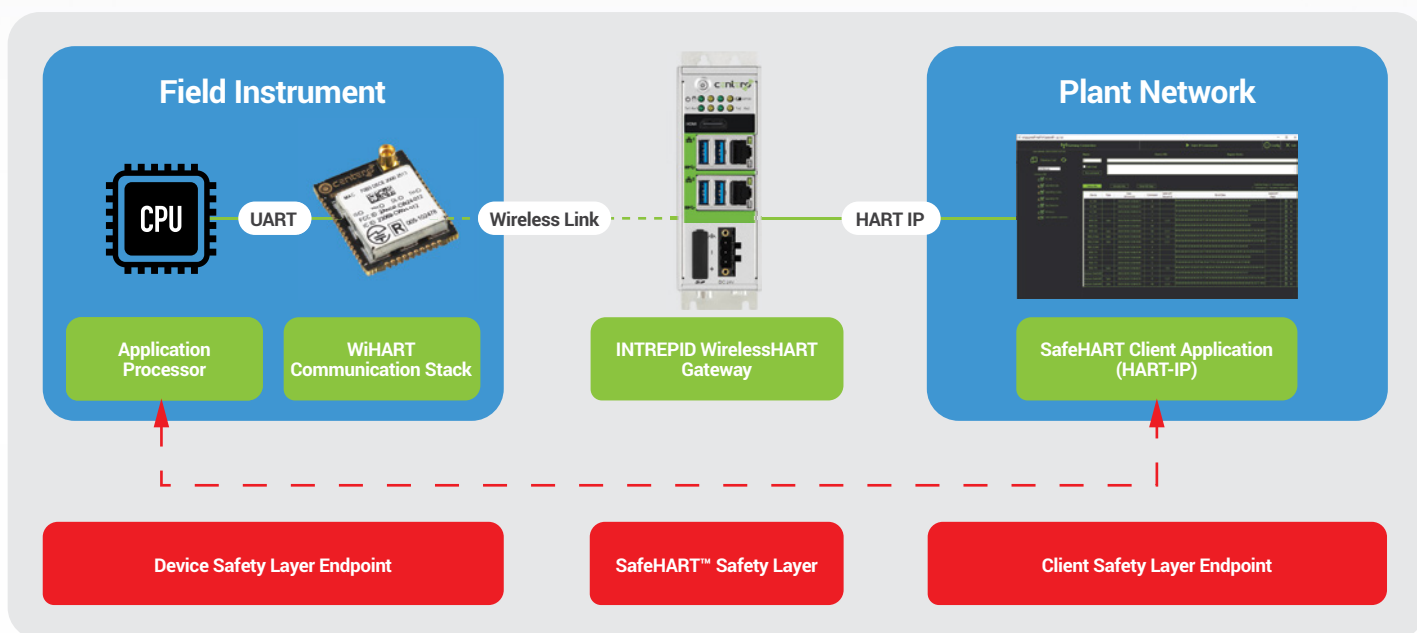
WirelessHART Network Management

The INTREPID WFNM hosts the WirelessHART network manager entity. The WirelessHART network manager is responsible for managing and ensuring the proper functioning of all WirelessHART field instruments. It manages all aspects of these devices throughout their entire lifecycle including the provisioning, configuration and joining phases as well as the operational and decommissioning phases.

Provisioning

All WirelessHART field devices including field instruments and Wireless Access Points need to be provided the appropriate security credentials that will allows them to securely join the WirelessHART network. These security credentials are provided during the provisioning phase. The INTREPID Gateway supports individual or batch provisioning of field instruments.

WirelessHART Network Management (continued)

Join and Network Formation

The network manager is also responsible for discovery of the field instruments that want to join the WirelessHART network, and jointly with the security manager also responsible for the join process. Once devices have joined, the network manager will configure the field instruments to form mesh subnets that are optimized to ensure the highest level of reliability for the wireless communications as well as prolonging the battery life of these instruments. Reliability of wireless communications is ensured through path diversity (mesh topologies), frequency diversity (frequency hopping) and time diversity (TDMA) as well as optimal wireless media contention/access. All these mechanisms are managed by the network manager that collects health diagnostics and continuously improves the reliability of communications of field instruments as well as the entire mesh network.

Operational Management

Once the field instruments have joined the WirelessHART network, the network manager is responsible for managing the operation of these instruments according to their intended needs. This includes allocating network resources to meet the instrument's requirements. The INTREPID WirelessHART network manager accommodates field instruments that are engaged in both monitoring as well as control applications and use cases.

It will allocate network resources to allow the instruments to periodically publish the process values and health diagnostics based on their requirements. It will also allocate network resources to allow these instruments to have bi-directional communications with the Gateway as well as send alerts/alarms as needed.

Security Features

The INTREPID WFNM includes advanced security features and mechanisms that ensure data confidentiality, authenticity, integrity, and availability for WirelessHART connectivity.

WirelessHART Security

The INTREPID WFNM hosts the WirelessHART security manager entity that is responsible for managing all security facets of the WirelessHART field devices and network. This includes the join and provisioning process for all WirelessHART field devices and Access Points. Once the WirelessHART field devices have joined the network the security manager oversees all security aspects during the operational life of the field device.

Network Provisioning Phase

A wired HART network provisioning tool is needed to inject the security credentials generated by the security manager into the field instrument. The INTREPID WFNM includes various access control mechanisms that only allow accredited field instruments to join the WirelessHART network.

Network Join Phase

The security manager is also responsible to managing the network join phase. The INTREPID WFNM also includes additional access control security features ensuring that only authorized field instruments are allowed to join the network. Following the successful completion of the join phase, the security manager hands out the appropriate cryptographic materials needed for the operational phase of the field instrument.

Operational Phase

WirelessHART networks use a two layered security construct that consists of link-layer (hop-to-hop) and network layer (end-to-end) security relationships. All data transactions are authenticated and optionally encrypted using AES-128 at the link-layer. Link-layer security (hop-to-hop) secures data transactions within the scope of the WirelessHART mesh network and terminates at the Wireless Access Point. All data transactions are authenticated and encrypted using AES-128 at the network layer. Network layer security secures transactions within the scope of the entire WirelessHART network and terminates in the Gateway. The security manager is responsible for security key management, including periodic key renewal and key revocation.

Gateway Access

Gateway access from the plant network is secured using SSL/HTTPS certificates. An airgap between the WirelessHART network and data accesses from the plant network ensures that the two networks are segregated from a security standpoint. All WirelessHART data transactions terminate in the Gateway, are buffered or stored and are accessible via various standards based high-side interfaces such as MODBUS or HART-IP. This adds to the robustness of the security construct by protecting the WirelessHART network from cybersecurity attacks that could potentially be initiated via the plant network.

WirelessHART Gateway Features

The WirelessHART Gateway software entity is responsible for the application layer connectivity between the WirelessHART field instruments and the plant network. It is responsible for receiving and sending as well as buffering, caching and storing application payloads. The Gateway also provides plant network connectivity via various standard based high-side interfaces.

The Gateway supports various data flows including burst data that is periodically sent by the field instruments (monitoring) or Gateway (control). It also supports bi-directional client/server data exchanges between the field instruments and the Gateway as well as alarms and alerts.

Over-the-Air Firmware Upgrades (OTA)
The INTREPID WFNM boasts upgrade capabilities of all firmware/software entities that are operational in the WirelessHART network. This includes support for secure Over-the-air firmware upgrades for all field instruments, including their wireless communication stacks running on the WiHART wireless modules and vendor specific firmware running on the application processor that are based on Centero's WirelessHART reference implementation. Over-the-air upgrades are performed via Centero's Utility Tool that resides on the plant network. All firmware upgrades are authenticated and secured and require explicit user activation.

Gateway Software Upgrades
All software and firmware entities running on the INTREPID WFNM are upgradeable via an AES-256 encrypted and authenticated, secure process.

Support for Large File Transfers (LFT)
The WirelessHART protocol supports the transmission of short data packets to conserve battery power and extend the battery life of the wireless field instruments. Various types of field instruments engaged in vibration, condition or corrosion monitoring collect larger files that need to be transmitted to the plant network for data reporting or further analysis.

The INTREPID WFNM supports the transmission of large files through an LFT (Large File Transfer) mechanism. Collection of large files via the LFT mechanism can be periodically scheduled or on demand as needed. The LFT mechanisms ensure that these large files are transmitted in a reliable and secure manner. It includes flow control as well as fragment recovery in case fragments of the large file are lost during the wireless transfer. Security of transfers are ensured through large file integrity and authenticity checks that are additional to the security mechanisms inherently present in the WirelessHART protocol. Large file transfers are performed via Centero's Utility Tool that resides on the plant network.
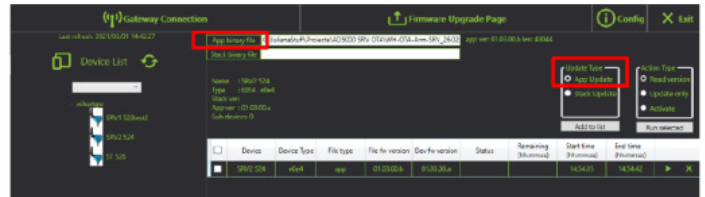

Plant Network Connectivity Interfaces

The INTREPID WFNM provides connectivity to the plant network through various standards-based interfaces.

MODBUS TCP
The INTREPID WFNM hosts a MODBUS TCP server that allows software entities running on the plant network to extract data reported by the ISA100 Wireless field instruments. Any of the data parameters reported by the field devices can be mapped into MODBUS registers including process data as well as health and diagnostics data. Gateway and Wireless Access Point diagnostics can also be mapped into MODBUS registers. It also supports control use cases by allowing users to map process values

into holding registers that are sent to the field instruments. Mapping parameters into the MODBUS TCP server is done via a user-friendly, drag-and-drop interface.
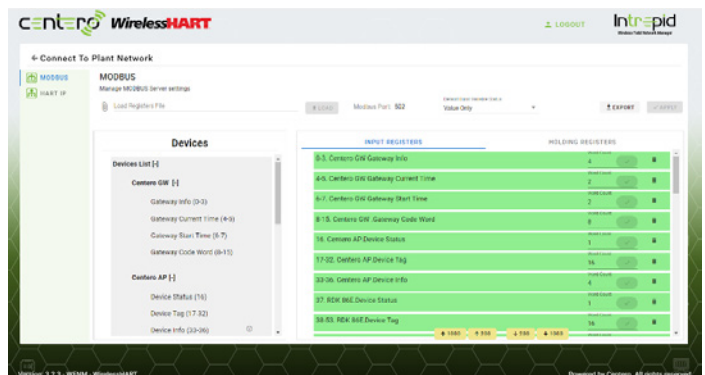
HART-IP

The HART-IP protocol is a standards-based, open technology that extends the original HART protocol to include communications across IP networks.

The INTREPID WirelessHART Field Gateway includes a HART-IP server that is compliant to the HART 7.7 protocol specification. It concurrently supports up to eight (8) TCP/UDP HART-IP client sessions with each client session requiring its own security credentials. HART-IP clients running on the plant network can subscribe to burst/publish process data streams sent by the WirelessHART field instruments. They can also send HART commands in a secure manner to the WirelessHART field instruments.

**TARGET VERTICAL MARKETS
AND APPLICATIONS**

Verticals
- Oil and Gas
- Petrochemical
- Paper and Pulp
- Mining
- Factory Automation
- Power Generation
- Power Distribution

Applications and Use Cases
- Process Automation
- Temperature and Pressure Monitoring
- Safety applications
- Condition Monitoring
- Valve Positioning and Control
- Steam Trap and Relief Valve Monitoring
- Predictive Maintenance
- Corrosion Monitoring
- Tank Level Monitoring

Specifications

WIRELESSHART SPECIFICATIONS		
Wireless Communication		Standard: IEEE 802.15.4 Data Rate: 250 kbps Modulation: Q-PSK Spread Spectrum: DSSS RF Output Power: Max +10 dBm Sensitivity: -104 dBm Link budget: 114 dB Communication Range: 0.75 miles (1200 meters LoS) Connector: SMA female
Antenna Options	Antenna 1	Direct mount, 2 dBi, omni-directional whip antenna, SMA male connector.
	Antenna 2	Remote mount, 4 dBi, omni-directional antenna for ATEX Zone 1 and 2 area classifications, SMA-male connector, with L-mount bracket for wall or pipe installations.
	Antenna 3	Remote mount, 8 dBi, omni-directional antenna for, N-male connector, with L-mount bracket for wall or pipe installations.
Scalability		Up to 250 WirelessHART field instruments

Specifications

WIRELESSHART SPECIFICATIONS	
Burst/Publish Report Rates	Configurable: 0.5s, 1s, 2s, 4s, 8s, 16s, 32s and 60s, multiples of 60 seconds

Scalability for Periodic Burst/Publish Rates Supported	Burst/Publish Rate	Number of Field Instruments
	0.5 seconds	10 field instruments[1,2]
	1 second	24 field instruments[1,2]
	2 seconds	32 field instruments
	4 seconds	64 field instruments
	8 seconds	128 field instruments
	8s, 16s, 32s, 1m, multiples of 1m	250 field instruments
	[1] Client/server (bidirectional) communication rate at max 7 seconds for each field instrument	
	[2] Number of concurrent wireless firmware upgrades - 3 field instruments	

|	
Mesh Network Depth	Configurable, up to 5 hops
HART-IP Interface	HART-IP server Sessions: up to 8 concurrent TCP/UDP sessions with session specific security credentials
MODBUS-TCP Interface	MODBUS TCP server − INPUT and HOLDING registers

CERTIFICATIONS AND COMPLIANCE	
Wireless Certifications	FCC/ISED Part 15.247, 15.407 ETSI EN 300 328 V2.2.2 (2019-07) per RED 2014/53/EU
Safety, EMI/ESD and Immunity	EN 301 489-1 V2.1.1 and EN 301 489-17 V3.1.1 • Emissions per EN5503 • IEC 61000-4-2 level 4 ESD immunity • IEC 61000-4-3 - RFI • EMC Immunity per EN 61000-6-2 and EN 61000-6-4
RoHS Compliance	Compliant to directive 2015/863/EU - RoHS 3

HARDWARE SPECIFICATIONS	
Dimensions	Imperial: 1.82″ (W) x 3.94″ (D) x 4.72″ (H) Metric: 46.2 mm (W) x 100 mm (D) x 120 mm (H)
Power	24 VDC ±20%
Installation	DIN rail or wall
Mounting Methods	Wall and pole
Environment Protection	Operating temperature: -20 to 70°C (per IEC60068-2-1, IEC60068-2-2, IEC60068-2-14) Storage temperature: -20 to 75°C

WARRANTY AND LICENSING	
Warranty	2 years
Licensing	No recurring license fees

Dimensional Drawings

Units: mm
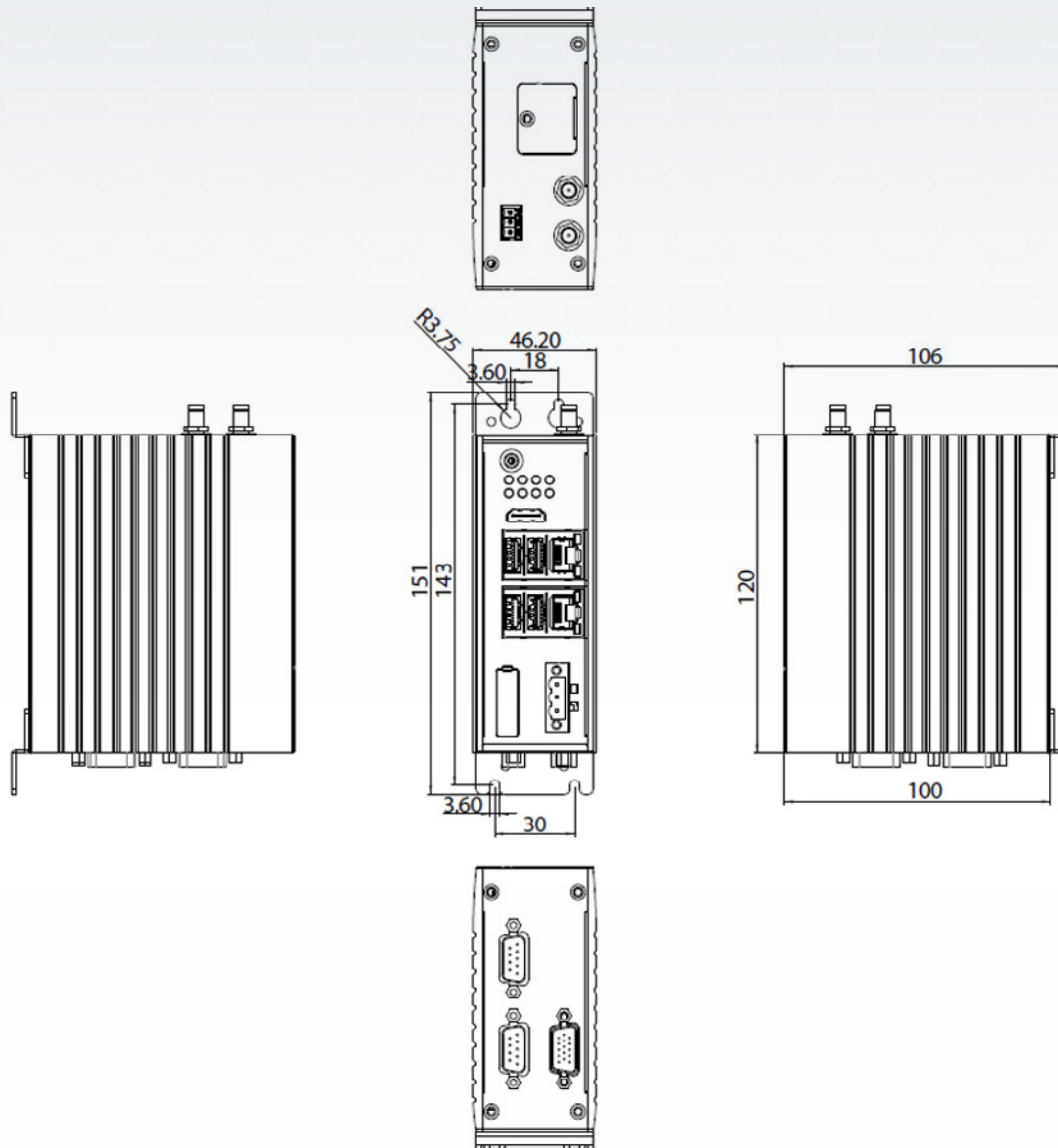
Ordering Information

Model	Part Number	Description
INTREPID WFNM	WFNM-LBA-WH	INTREPID WirelessHART Field Network Manager – supports up to 50 field devices
	WFNM-LA-WH	INTREPID WirelessHART Field Network Manager – supports up to 250 field devices
INTREPID WFNM - SafeHART	WFNM-LBA-WH-S	INTREPID WirelessHART + SafeHART™ Field Network Manager supports up to 50 WirelessHART field devices
	WFNM-LA-WH-S	INTREPID WirelessHART + SafeHART™ Field Network Manager– supports up to 250 WirelessHART field devices

Related Products

Model	Part Number	Description
INTREPID NIO200HAG	NIO200HAG-C1D2/ATEX	INTREPID WirelessHART Field Gateway, Wi-Fi Mesh+ connectivity, UL C1D2 or ATEX certified
INTREPID NIO200HAG + SafeHART	NIO200HAG-C1D2/ATEX-S	INTREPID WirelessHART +SafeHART Field Gateway, Wi-Fi Mesh+ connectivity, UL C2D2 or ATEX certified
INTREPID NIO200HRDK	NIO200HRDK	INTREPID WirelessHART Field Gateway, No Wi-Fi
INTREPID NIO200HRDK + SafeHART	NIO200HRDK-S	INTREPID WirelessHART + SafeHART Field Gateway, no Wi-Fi
WiHaRT Rapid Development Kit	WIHARTRDKEN	WirelessHART Rapid Development Kit
SafeHART™ Rapid Development Kit	SAFEHARTRDKEN	SafeHART Rapid Development Kit
WiHaRT2 Wireless Module	CW-24-200-WH	WirelessHART Wireless Module

Accessories

Part Number	Description
ANT-WFNM1	Omnidirectional 2.4 GHz, 2 dBi gain antenna, swivel, SMA male connector.
ANT-WFNM2	Omnidirectional 2.4 GHz, 2 dBi gain antenna, swivel, SMA male connector – suitable deployments in ATEX Zone 1 and 2 rated areas.
ANT-WFNM3	High-gain, omnidirectional 2.4 GHz, 8 dBi gain antenna, N-male connector.
7A00000066X00	RF lightning arrester N-MALE to N-FEMALE
3M	RF cable – N-connectors – 3 meters length
6M	RF cable – N-connectors – 6 meters length
9M	RF cable – N-connectors – 9 meters length

Centero is a provider of wireless technologies, products and services for the Internet of Things.

DP-FLOW

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