GE
Grid Solutions

MDS Master Station

Exceptional Reliability for Protected Licensed Communications

Licensed narrowband communication networks are deployed to monitor, control and maintain critical industrial processes and distributed assets. Such applications require high reliability and availability especially at the access point, thus driving demand for high duty cycle solutions with built-in redundancy that are capable of continuous operation. The MDS Master Station is built to meet these demanding requirements.

When configured in a redundant mode, the MDS Master Station offers two transceivers in a 1+1 redundancy, and dual power supplies to maximize network availability. In the event of a failure the controlling logic switches to the standby transceiver unit. Switchover can occur based upon transceiver error codes, loss of communication over a configurable time period or loss of power.

The MDS Master Station supports two types of licensed transceiver modules. SD transceiver modules enable the deployment of MDS SD Series networks. They further allow for backward compatibility with x710/x790 legacy networks as well as newer Orbit networks. Orbit transceiver modules enable the deployment of Orbit licensed narrowband networks with up to 64-QAM with bi-directional Adaptive Modulation to maximize throughput for bandwidth intensive applications.

Key Benefits

- Maximize network availability with 1+1 transceiver protection and hot-swappable components
- Flexibility of integration into MDS SD series, MDS X710/X790 as well as MDS Orbit Licensed Narrowband radio networks
- Repurpose narrowband spectrum for bandwidth intensive applications with Orbit's technology
- Advanced networking and security capabilities ensure seamless integration in modern networks
- Integration with the MDS PulseNET network management system

Applications

Oil & Gas

- SCADA communication for flow/metering devices, controllers and RTUs
- Data acquisition for well head production data and pipeline status

Energy

- SCADA communication for IEDs, controllers and RTUs at distribution substations
- Data acquisition for pole-top transformers and capacitor banks

Water/Wastewater

- SCADA communication for lift station controllers and monitoring devices
- Data acquisition for tank and reservoir levels, flow rates and pipeline valve status

imagination at work

Reliability and Modularity

- 1+1 transceiver redundancy with warm standby and fast radio switchover
- Various AC/DC power supply options with redundant operation
- Modular, in-service, hot-swappable components
- Operation from -30 to +60 °C
- Rated for continuous operation
- No moving parts or fans
- Battery backup option

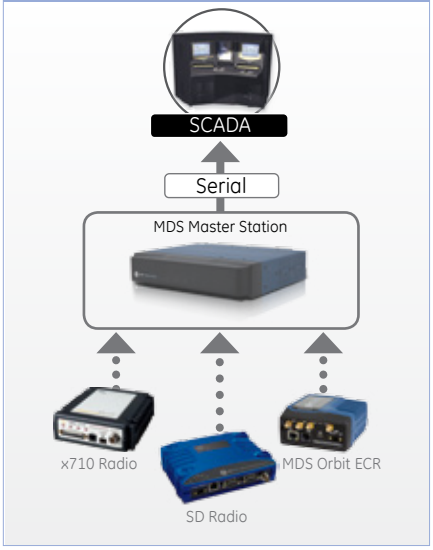
Flexibility

- Support for GE MDS SD Series radio technology covering the 300-512 MHz and 880-960 MHz bands with backward compatibility to legacy X710/X790 systems
- Support for GE MDS Orbit Licensed Narrowband technology with QAM and covering the 330-470MHz, 896-960MHz, and 700MHz upper A Block bands
- Optional internal duplexer
- Connectivity for additional notched filter

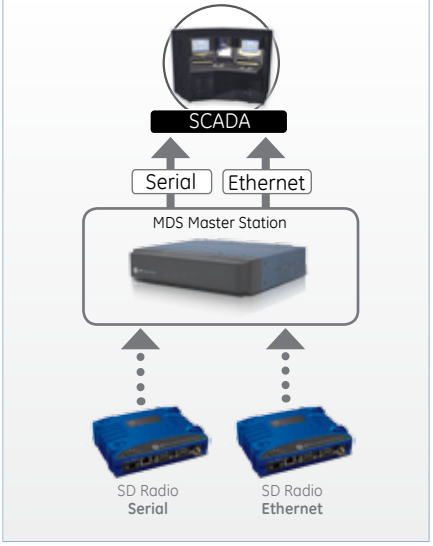
Advanced Networking & Security

- Orbit Network Operating System with advanced routing, switching, Quality of Service and network management capabilities
- Cutting edge cyber security suite including firewalling, RF Encryption, end-to-end IPSec VPNs, X.509 certificates with key rotation, secure boot and firmware

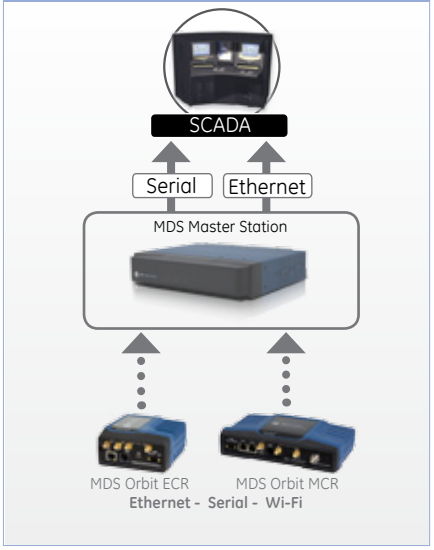
MDS Master Station Configured with SD Transceivers for Backward Compatible Serial Operation



MDS Master Station Configured with SD Transceivers for IP and Serial Operation



MDS Master Station Configured with Orbit Licensed Narrowband Transceivers for Higher Speed QAM



MDS Master Station Overview

The MDS Master Station is built on an cutting edge hardware framework to offer exceptional reliability for critical licensed communications. It can be configured as a 1+1 system with redundant power supplies and transceivers that are hot-swappable to ensure always-on operation and maximize network availability. Other components such as duplexers and alarm cards are also modular and can be field replaceable for ease of maintenance.

The Master Station utilizes a variant of the GE MDS Orbit network Operating System (Orbit OS) offering future-ready security, networking and quality of service capabilities.

Enterprise-Class Security

The MDS Orbit OS offers a comprehensive cyber security framework to facilitate the deployment of highly secure networks. Orbit's firewall ensures protection at Layer 2 to 4 to permit only valid traffic through the network. Its RF encryption secures communication between remote and AP while its IPSec VPN and DMVPN capabilities enable end-to-end encryption between remotes and control center. RADIUS enforces a centralized authentication process where users are granted access based on pre-authorized roles and access level.

Flexible Networking and Quality of Service

MDS Orbit OS enables the Master Station to offer dynamic and static routing services as well as full managed switch capability for maximum flexibility in network design. In addition to 1+1 transceiver protection, Orbit OS offers other High Availability mechanisms when used with MDS Orbit remotes such as interface bonding, Spanning Tree, Layer 3 failover, VRRP as well as latency and packet-loss based failover. Quality of Service enables the granular classification and prioritization of traffic as well as the dedication of uplink throughput on a per-application basis to minimize latency and maximize bandwidth for critical applications.

MDS Master Station with SD Radio Modules

The MDS Master Station can be configured with SD transceiver modules in a non-redundant or redundant mode of operation to allow communication within the 880-960 MHz, 300-512 MHz bands. SD transceiver modules utilize a similar radio technology as the industry-leading MDS SD Series radios to enable communication with MDS SD remotes, as well as MDS x710 and x790 remotes. This backward compatibility allows the seamless co-existence of legacy and SD based networks.

Furthermore when operating in the CPFSK A modem, the SD transceiver module can communicate with MDS Orbit remotes operating in a legacy backward compatible mode to facilitate the migration of such networks to Orbit-based technology.

MDS Master Station with Orbit Licensed Narrowband Modules

The MDS Master Station can be configured with the newer MDS Orbit Licensed Narrowband radio modules covering the 896-960 MHz, 330-520 MHz**, and the 757-758 and 787-788 MHz bands. The Orbit Licensed Narrowband radio modules enable communication with the MDS Orbit MCR/ECR remotes using its high performance radio technology with up to 64-QAM of modulation for a 120Kbps of data rate at 25KHz. Its bi-directional adaptive modulation as well as IP header and payload compression maximize upstream and downstream throughput. Furthermore, Dynamic Forward Error Correction (FEC) boost link sensitivity to maximize distance and operation in tough terrains.

Network Management and User Interface

The MDS Master Station with its Orbit OS supports standards-based SNMP and Netconf network and device management protocols for easy integration into MDS PulseNet and 3rd party NMS software. It can be configured and managed using Command-Line Interface (CLI) or an intuitive Graphical User Interface (GUI).

Licensed Evolution Module

Migrating networks is seamless with the MDS Master Station. Its upcoming Evolution Module is a smart RF switch and logic that makes the master station a single-box solution to migrate serial legacy networks operating on virtually any modem over to Orbit based Licensed Narrowband networks. Please check with your GE MDS Sales Manager for availability.

Versatile Serial Server

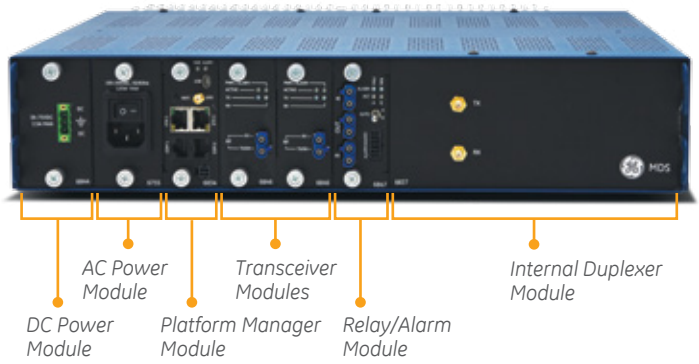
Serial traffic from SCADA and telemetry data can be encapsulated in TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) for point-to-point or point-to-multipoint transport across wired and wireless networks. Serial protocols, such as Modbus and DNPv3 are fully supported to connect legacy PLCs, RTUs etc...

Modular Communication Platform

All components in the MDS Master Station are easily accessed from the front panel for simplified maintenance. Redundant transceivers and power supply modules are hot-swappable to ensure continuous operation during service periods. The Relay and Alarm module provides connectivity for two sets of alarm contacts to externally signal radios switchover and alarm events. LEDs show current status of active and standby transceivers.

The Master Station's Platform Manager is the main processor/brain of the system. It can be factory-configured with an optional WiFi to simplify local management. It also supports 2 Ethernet and 2 Serial interfaces, and allows for single or multiple SCADA host systems.

Exterior View – Front Panel



Graphical User Interface (GUI)

The MDS Master Station utilizes an intuitive Device Manager GUI based on the Orbit Network Operating System. The Device Manager allows for easy configuration and maintenance of radios, networking, security and management functions with specialized wizards that speed up complex configuration tasks. The Master Station can also be managed using a CLI.

Opening Screen for Master Station MDS Device Manager

MDS Master Station Configuration Options

The MDS Master Station can be factory-configured as a system with either of the following two radio technology types: SD or Orbit Licensed Narrowband. The system can be configured with single or dual redundant radio modules of the same type. Components such as chassis, power supplies, platform manager (processor), alarm modules and duplexers are common between the two types of systems to enable flexibility in field upgrades and maintenance and inventory stocking. Master Station firmware shipping in late Q3 2016 shall support systems configured with either SD or Orbit Licensed Narrowband transceiver modules. Most of the hardware components listed above can be ordered as spares, please check the Grid Solutions online store or with a GE Sales representative for more information.

MDS Master Station loaded with	Compatible with	Modulations	Max Raw Data Rate in 25KHz	Duplex Modes	Firmware , Networking, Security, Management
SD RADIO MODULES	• MDS SD Series remotes • MDS x710/x790 remotes • MDS Orbit Licensed Narrowband remotes operating in CPFSK modulation	• CPFSK	38.4 Kbps	Half Duplex Full Duplex	Orbit Network Operating System on Master Station Only
ORBIT LICENSED NARROWBAND RADIO MODULES	• MDS Orbit Licensed Narrowband Remotes	• QPSK, 16QAM, 64QAM • Bi-directional Adaptive Modulation	120 Kbps	Half Duplex	Orbit Network Operating System on Master Station and Remotes

Technical Specifications

The MDS Master Station system can be factory-configured with either SD radio modules, or Orbit Licensed Narrowband radio modules. Each module type can also be purchased separately to facilitate customer-driven field maintenance and future SD to Orbit technology upgrades.

ORBIT LICENSED NARROWBAND RADIO MODULES

Module Configuration	Single, Protected 1+1
Frequency	Configurable
Duplex Modes	Half duplex
Modulation	QPSK, 16QAM, 64QAM
Adaptive Modulation	Per-packet, per-remote, bi-directional
Dynamic FEC:	Convolutional, Reed Solomon
Compression	IP Header and Payload with up to 30% efficiency improvement
Media Access Control	High performance MAC

ORBIT LICENSED NARROWBAND MODULE BANDS

330-406 MHz
406.1-470 MHz
757-758 and 787-788 MHz
896-960 MHz

RAW DATA RATES

Channel	QPSK	16QAM	64QAM
6.25 KHz	9.6 Kbps	19.2 Kbps	28.8 Kbps
12.5 KHz	20 Kbps	40 Kbps	60 Kbps
25 KHz	40 Kbps	80 Kbps	120 Kbps
50 KHz	TBA	TBA	TBA

TRANSMITTER CHARACTERISTICS

Frequency Stability	+/- 0.5ppm	
Peak Power*	**330-470MHz**	**896-960MHz**
- Radio Module	39.28	38.8
- Non-Redundant, no duplexer	38.93	38.05
- Non-Redundant, with duplexer**	37.73	35.95
- Redundant, no duplexer	38.4	37.25
- Redundant, with duplexer**	37.2	35.15
Power Range	+20dBm to +40dBm	
Output Impedance	50 Ohms	

**dBm +/-0.5dB, QPSK Average Power is 5dB less than Peak, QAM Average Power is 7dB less than Peak*

***With GE MDS standard 400MHz notch or 900MHz bandpass duplexers*

RECEIVER CHARACTERISTICS

Type	Direct Conversion		
Adjacent Channel	60 dB nominal		
Receiver Sensitivity (Actual)	@ 1x10-6 BER, No FEC		
Channel	**QPSK**	**16QAM**	**64QAM**
12.5 KHz	-116 dBm	-108 dBm	-100 dBm
25 KHz	-113 dBm	-105 dBm	-97 dBm
Receiver Sensitivity (Actual)	@ 1x10-6 BER, with FEC Max		
Channel	**QPSK**	**16QAM**	**64QAM**
12.5 KHz	-119 dBm	-111 dBm	-101 dBm
25 KHz	-114 dBm	-106 dBm	-98 dBm

SD RADIO MODULES

Module Configuration	Single, Protected 1+1
Frequency	Configurable
Duplex Modes	Full duplex, half duplex, simplex
Modulation	Digital, CPFSK
Radio Mode Compatibility	Packet-with-MAC, Transparent MDS X710 Series MDS SD Series MDS Orbit in CPFSK A Modem

SD MODULE BANDS

SDM4 D	300-360 MHz
SDM4 B	400-450 MHz
SDM4 C	450-512 MHz
SDM9 C	928-960 MHz
SDM9 K	TX 926-960 MHz RX 880-915 MHz

RAW DATA RATES

Channel	400-512 MHz	880-960 MHz
6.25 KHz	4.8 Kbps	-
12.5 KHz	19.2 Kbps	19.2 Kbps
25 KHz	38.4 Kbps	38.4 Kbps
50 KHz	-	-

TRANSMITTER CHARACTERISTICS

Frequency Stability	+/- 0.5ppm	
Peak Power	**400-512MHz** (dBm +/- 0.5dB)	**928-960MHz** (dBm +/- 0.85dB)
- Radio Module	40.5	40.25
- Non-Redundant, no duplexer	40.0	39.5
- Non-Redundant, with duplexer*	38.8	37.4
- Redundant, no duplexer	39.4	38.7
- Redundant, with duplexer*	38.2	36.6
Power Range	+30dBm to +40dBm	
Duty Cycle	Continuous	
Output Impedance	50 Ohms	

**With GE MDS standard 400MHz notch or 900MHz bandpass duplexers*

RECEIVER CHARACTERISTICS

Type	Double Conversion Superheterodyne
Adjacent Channel	60 dB Nominal Rejection
Sensitivity	-110dBm typical @ 1x10-6 BER

ELECTRICAL

Power Required	< 80 Watts (based on redundancy)
DC Power	+/- 12-36V, +/- 36-72V, +/- 75-140V
AC Power	90-260V, 50/60 Hz

MECHANICAL

Dimensions	8.9Hx43.8Wx40.6D cm 3.5Hx17.2Wx16D in
Weight	10.9 kg, 24 lbs

ENVIRONMENTAL

Temperature	-30°C to 60°C (-22°F to 140°F)
Humidity	95% at 40°C (104°F) non-condensing
Cooling	Heat sinks, no fans, no moving parts

WI-FI OPTION

- Frequency 2.4GHz with IEEE 802.11 b/g/n
- Data Rate up to 54Mbps
- Operating Modes: Access Point, Station
- Scalability Up to 2 SSIDs, up to 7 clients/stations
- SSID hiding Yes | VLAN mapping Yes
- Security WPA/WPA2 PSK, Enterprise
- Carrier Power 20dBm adjustable

INTERNAL DUPLEXER OPTIONS

- 9 MHz (932.0-932.5) / (941.0-941.5) MHz
- 24 MHz (928.0-929.0) / (952.0-953.0) MHz
- 31 MHz (928.0-929.0) / (959.0-960.0 MHz
- 39 MHz (896.0 - 898.0) /(935.0 -937.0) MHz
- 350-512MHz / 5-10MHz SP (INT)
- No Internal Duplexer

NETWORKING

- IPv4 Routing OSPF, EBGP, RIPv2 with performance-based route failover, IPv6 Routing**
- Full managed switch capability, IEEE 802.3, 802.1Q/VLANs, 64 VLANs, STP
- Concurrent Bridging & Routing
- GRE Tunneling with Layer 2 (Ethernet) and Layer 3 support
- Route/path failover between any two wireless/Ethernet interfaces based on link loss, latency degradation or packet loss thresholds
- Quality of Service 16 egress queues, Priority Queuing, Fair Queuing, Traffic Shaping, Classification based on DSCP, 802.1p and Layer 2-4 classifiers
- IP Protocols TCP, UDP, ARP, DHCP, ICMP, NTP, FTP, SFTP, TFTP, DNS, configurable HTPP and HTTPS, SSH
- Serial TCP server, Modbus/TCP, Modbus RTU, TCP client, UDP Unicast and Multicast, BSAP, and DNP3

SECURITY

- IPSec VPN Server (responder) and Client (initiator) with DMVPN
- Authentication Public Key, EAPTLS, Pre-Shared, Ike 1-2
- Encryption : 3DES, AES 128/192/256, CBC, CTR, CCM, GCM, SHA 256/384/512 HMAC
- Firewalling: Stateful Layer 3-4 Firewall with MAC Filtering, NAT, Source NAT (Masquerading), Static NAT, Port Forwarding
- Device Security : Secure Boot, Secure Firmware, Digitally Signed Hardware and Software, Magnetometer Tamper Detection
- Certificate Management: X.509, SCEP, PEM, DER, RSA
- User Authentication: Local RBAC, AAA/RADIUS, 802.1x
- FIPS 140-2 (Level 2) certification in progress

MANAGEMENT

- GE MDS PulseNET NMS Support with device management and auto-provisioning
- GUI configuration Wizards to simplify operation
- Secure device management via an intuitive web-based GUI and/or CLI
- Event logging, Syslog-over-TSL, SSH, Console
- Iperf throughput diagnostic, NETCONF
- SNMPv1/v2c/v3, MIB-II, Enterprise MIB

INTERFACES

Serial COM1	RS232, RJ45
Serial COM2	RS232/485, RJ45
USB	2
Ethernet 1	10/100 BaseT, RJ45
Ethernet 2	10/100 BaseT, RJ45
Wi-Fi	Optional
GPS	Standard starting 9/2016
Antenna	N Female

AGENCY APPROVALS

Master Station with SD Radio Modules
Industry Canada and ENTELA
FCC Part 101: 820 to 960 MHz
FCC Part 90: 928 to 960 MHz
FCC Part 24: 820 to 960 MHz
FCC Part 90: 300 to 512 MHz
CE, ETSI: 300 to 512 MHz
UL 60950-1 Safety approval

Master Station with Orbit Licensed Narrowband Radio Modules
Industry Canada, Anatel
FCC Part 90: 896-960 MHz
FCC Part 90: 406-470 MHz
FCC Part 27: 757-758 & 787-788 MHz
CE, ETSI: 330-406 MHz, 406-470 MHz
CSA General Safety approval

WARRANTY

Standard 2-year manufacturer warranty applies to all MDS Master Station models

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