GE

Digital Energy

D20MX

Substation Controller

Instruction Manual

994-0140

Version 1.5x Revision 0

WORLDWIDE 10 YEAR WARRANTY

imagination at work

GE Information

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D20MX Substation Controller

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D20MX Substation Controller

Product Support

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- Access the GE Digital Energy Web site
- Search the GE Technical Support library
- Contact Technical Support

Access the GE Digital Energy Web site

The GE Digital Energy Web site provides fast access to technical information, such as manuals, release notes and knowledge base topics.

Visit us on the Web at: http://www.gedigitalenergy.com/

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This site serves as a document repository for post-sales requests. To get access to the Technical Support Web site, go to:

http://site.ge-energy.com/prod_serv/products/substation_automation/en/tech_support_login.htm

Contact GE Digital Energy technical support

GE Digital Energy Technical Support is open 24 hours a day, seven days a week for you to talk directly to a GE representative.

In the U.S. and Canada, call toll-free: 1 800-547-8629

International customers, please call: + 1 905-927-7070

Or e-mail to multilin.tech@ge.com

Have the following information ready to give to Customer Service:

- Ship to address (the address that the product is to be returned to)
- Bill to address (the address that the invoice is to be sent to)
- Contact name
- Contact phone number
- Contact fax number
- Contact e-mail address
- Product number / serial number
- Description of problem

The Customer Service centre provides you with a case number for your reference.

Product returns

A Return Merchandise Authorization (RMA) number must accompany all equipment being returned for repair, servicing, or for any other reason. Before you return a product, please contact GE Digital Energy to obtain an RMA number and instructions for return shipments.

You are sent the RMA number and RMA documents via fax or e-mail. Once you receive the RMA documents, attach them to the outside of the shipping package and ship to GE Digital Energy.

Product returns are not accepted unless accompanied by the Return Merchandise Authorization number.

Upgrade your D20MX processor firmware

The firmware of your D20MX Substation Controller can be upgraded to provide the latest functionality and improvements.

Go to the D20MX Substation Controller web page at http://www.gedigitalenergy.com/app/ViewFiles.aspx?prod=d20mx&type=7 to download the upgrade software.

D20MX Substation Controller

About this Document

Purpose

This manual provides information about installing, setting up, using and maintaining your D20MX™ Processor. This manual does not provide any procedures for configuring the software of the D20MX.

Intended audience

This manual is intended for use by field technicians and maintenance personnel who are responsible for the installation, upgrade, wiring and maintenance of SCADA equipment. This manual assumes that the user is experienced in:

- Electrical utility applications
- Electrical wiring and safety procedures
- Related other manufacturers' products, such as protective relays and communications equipment

Additional documentation

For the most current version of the D20MX Hardware User's Manual, please download a copy from: http://www.gedigitalenergy.com/app/ViewFiles.aspx?prod=d20mx&type=3

For further information about the D20MX, refer to the following documents.

- *SGConfig™ Online Help*
- D20/D200 Installation and Operation Guide, 994-0078
- Application Configuration Guides and User Guides, available on the D20MX Documentation CD (GE part number 588-0075) or extracted zip file.

How to use this manual

This manual describes how to install the D20MX and get it up and running for the first time.

Procedures are provided for all component options available for the D20MX. The components included in your D20MX depend on what was ordered for your substation application.

The software-related procedures in this manual are based on using a computer running Windows® 7. Some steps and dialog boxes may vary slightly if you are using another version of Windows.

Document conventions

The following typographic conventions are used throughout this manual:

Bold face is used for:

- Names of software program menus, editors, and dialog boxes; also for the names of menu commands, keyboard keys, icons and desktop shortcuts, and buttons and fields in editors and dialog boxes
- Names of hardware components
- User input that must be typed exactly

Italic face is used for:

- Emphasis
- Cross-references to sections, figures and tables within this manual and for titles of other documents
- File and directory names; examples of directory paths are generally given in the Windows format
- Placeholders for user input that is specific to the user. May also include angle brackets around the placeholder if the placeholder is already in italic text. For example, c:\<*product*>\product.def
- References to a parameter or field value shown

Safety words and definitions

Before attempting to install or use the device, review all safety indicators in this document to help prevent injury, equipment damage or downtime.

The following safety and equipment symbols are used in this document:

Indicates a hazardous situation which, if not avoided, results in death or serious injury.

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Indicates practices that are not related to personal injury.

D20MX Substation Controller

Chapter 1: Before You Start

The D20MX Substation Gateway is a specialized computing platform which executes communications and energy management applications for monitoring and control of electrical substations. The D20MX is capable of consolidating data from multiple slave devices connected through communication channels (DCA: Data Collection Applications) and D20 Input / Output Modules in a single database. The D20MX can execute local logic, aggregate data, process data through one of multiple applications (DTA: Data Translation Applications) and report data upstream to master stations through different server protocols (DPA: Data Processing Applications).

The new D20MX processor card is a pin-for-pin compatible replacement for all generations of the D20 SBC, providing the latest revisions of common D20 applications and performance enhancements to support NERC-compliant Cyber security.

Before you begin installing and using the D20MX, review the information in this chapter, including the following topics:

- Safety precautions
- Regulatory compliance information
- Product overview
- Product specifications
- Storage recommendations

Read and thoroughly understand this manual before installing and operating the unit. Save these instructions for later use and reference.

WARNING! Failure to observe the instructions in this manual may result in death or serious injury.

Safety precautions

Follow all safety precautions and instructions in this manual.

Only qualified personnel should work on the D20MX. Maintenance personnel should be familiar with the technology and the hazards associated with electrical equipment.

- *Never* work alone.

- Before performing visual inspections, tests, or maintenance on this equipment, isolate or disconnect all hazardous live circuits and sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of back feed.
- Turn off all power supplying the equipment in which the D20MX is to be installed before installing and wiring the D20MX.
- Operate only from the power source specified on the installed power supply module.
- Beware of potential hazards and wear personal protective equipment.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.
- All AC voltage terminals are protected from accidental contact by a mechanical safety shield.
- All electronic components within the D20MX are susceptible to damage from electrostatic discharge. To prevent damage when handling this product use approved static control procedures.
- Hazardous voltages can cause shock, burns or death. To prevent exposure to hazardous voltages, disconnect and lock out all power sources before servicing and removing components.
- If the D20MX is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.
- Changes or modifications made to the unit not authorized by GE Digital Energy could void the warranty.

Warning symbols

Table 1 explains the meaning of warning symbols that may appear on the D20MX.

Table 1: Warning symbols

Symbol	Description
	The relevant circuit is direct current.
	The relevant circuit is alternating current.
	**Caution:** Refer to the documentation for important operation and maintenance instructions. Failure to take or avoid specified actions could result in loss of data or physical damage.
	**Warning:** Dangerous voltage constituting risk of electric shock is present within the unit. Failure to take or avoid specified actions could result in physical harm to the user.
	Earth/Ground Terminal
	Protective Ground Terminal
	**Caution**: Hot Surface

Product overview

The D20 is a standalone remote terminal unit (RTU). It consists of a D20MX processor board, power supply, optional termination panels, and optional communications equipment in a 3U tall, 19-inch wide chassis. These components, combined with software applications running on the D20MX, form the D20 RTU System.

The D20 acts as a data concentrator and central processor. Field data gathered through the peripheral modules and external Intelligent Electronic Devices (IEDs) are stored in the system database and can be accessed by the application programs loaded on the D20.

Product design

The D20 design has horizontally mounted processor boards, with multiple boards in some versions.

The D20 is available in a Kit form, for self-assembly, and as factory-assembled RTUs.

Peripheral I/O boards operate independently of the main chassis and D20MX processor board. This means that you can:

- Use a D20 without direct connection to peripheral boards so that it acts as a master data concentrator to other RTUs.
- Hot-swap the peripherals without powering down the main processor. For information on peripheral modules, see the *D20/D200 Installation and Operations Guide* (part number 994-0078); see section: *Connections and Configuration*.

Assembling a D20

Many add-on options are available for the D20 systems, to provide different operational performance and functions. Typically, the D20 systems consist of a Main Chassis with required Peripheral I/O boards.

Other components

To complete a basic D20 device, several other components are required:

- Peripheral I/O modules
- D.20 Link for communication between the main board and the peripherals
- Interposing Relay Panels, the need for which depends upon the load characteristics of the device that is controlled by the D20K or D20C control peripherals. If this rating exceeds the contact rating of the D20K or D20C control peripheral boards, then an Interposing Relay Panel is required. See “Interposing relays” on page 56.

When using bit-based synchronous protocols a Universal Protocol Converter (UPC) board is required to convert from byte to bit and back. The D20 communicates asynchronously over its serial ports.

The jumper settings on the UPC are protocol-specific. See “Universal Protocol Converter” on page 57.

Redundant system configuration

If you are building a redundant system, you need additional cables to link the active and standby units. See “D20 Gateway system redundancy” on page 63.

D20MX processor

The D20MX is a single board computer built around a 667 MHz embedded PowerQUICC II Pro processor. The D20MX supports open standard cyber security features that allow interoperability in NERC CIP environments and introduces compliance to IEC standards; refer to *Appendix A, Standards & Protection* for the complete listing.

The D20MX can be retrofitted into any of the following three chassis:

- A D20 3U single-node horizontal slot VME chassis.
- A D20 3U horizontal slot non-VME chassis. In a single-node VME chassis, this one processor module replaces the previous D20 M, M++, ME, and MEII CPU cards.

Due to aging printed circuit board assembly and mechanical constraints, only certain chassis from 2002 and onward can be used with a D20MX. This comprises the following chassis:

- D20 VME chassis 500-0280 Release 08 or higher,
- D20 Non-VME chassis 500-0305 Release 18 or higher

A solid partition between the Main processor bay and accessory bay prevents access to the harness from the fiber card to D20MX card (only applicable to the 526-3005LF fiber card version).

Security

The D20MX provides the following new security improvements over its predecessors:

- Centralized user authentication and authorization (RADIUS), including integration with Microsoft Servers using NPS
- Role Based Access Control (RBAC) keeping operator and engineering activities separated, logged and simple
- NERC compliant passwords, with strong complexity rules and one-way encrypted
- Full auditing including Syslog integration to enterprise systems
- SFTP for secure network-based firmware upgrades and configuration file transfers
- SSH for secure network access to WESMAINT II+. and the LogicLinx Executor. Refer to Appendix E: “Secure Connection for LogicLinx” on page 181 for details on securing network access to the LogicLinx Executor.

To take advantage of these improvements, refer to the WESMAINT II+ for the D20MX Configuration Guide (B014-1NCG) for details of these security features of the D20MX.

CyberArk

A plug-in available from CyberArk Software Ltd. enables the D20MX to be integrated with the CyberArk Privileged Identity Management (PIM) Suite. In addition to centralized user authentication and authorization, integration with CyberArk, PIM provides a one-time password model for the D20MX.

Contact CyberArk (http://cyberark.com) for details.

D20MX applications

Table 2 lists the applications included in the D20MX firmware.

* An Application ID containing an “N” (e.g., A009N) signifies a unique application definition for the D20MX.

† The D20MX version of the application is based on this D20 classic application version. However, the D20MX version is not identical to the D20 classic version due to minor changes to improve the robustness and security of the original application.

‡ The version of B009 in SAN0002 is actually based on D20 classic application version 401 but modified to be compatible with the version 310 application definition version.

Φ The version of B021 in SAN002 is actually based on D20 classic application version 991 but modified to be compatible with the version 912 application definition version.

Table 2: D20MX applications

License Group	D20MX Application ID	Base D20 Classic Application Version †	Application Name	Description
Common Application Definitions				
001	A009N	805	PG&E DPA for D20MX	Pacific Gas and Electric (PG&E) data-processing application (DPA) for remote terminal units (RTUs).
001	A017N	131	Distributed Network Protocol V1.00 DCA for D20MX	Distributed Network Protocol (DNP) V1.0 Data Link Application. Required by the Quantum Meter Scanner DCA.
001	A018	120	Quantum Meter Scanner DCA	The Quantum Meter Scanner DCA obtains data from one or more Quantum Meters via the DNP interface.
001	A023N	423	CDC Type I DPA for D20MX	The CDC Type I DPA emulates a CDC Type I RTU
	A026-1	322	Communication Watchdog DTA	Reports on the state of communications between the RTU and a remote device (Data Translation Application).
	A027N	832	SOE Logger DTA for D20MX	The Sequence-of-Events Logger DTA processes sequence of events (SOEs) from any sub-set of the system digital input and/or analog input points.
	A030	300	Accumulator Freeze DTA	Detects system status point changes and system accumulator point freezes.
001	A033-5N	211	TEJAS V DPA for D20MX	Emulates a remote terminal unit utilizing the (Valmet/Metso/Telvent) TEJAS V communication protocol.
	A035	211	Analog Reference DTA	Monitors analog input points and provides the system database with pseudo analog values that represent either correctly functioning analog input hardware (good reference value), or failed analog input hardware (bad reference value).
001	A036N	421	ProLogic Executor DTA for D20MX	Provides user programmable soft logic automation functionality.
001	A041-1	116	Proportional Integral Derivative Control DTA	The Proportional, Integral and Derivative (PID) DTA uses the generally-accepted industry standard for control of closed loop processes.
	A048	210	Status Combination DTA	Provides one ore more DI points, each of which provides an event-driven logical OR of a set of mapped system DI points.
	A059-0N	911	Modbus DCA for D20MX	Acts as a data concentrator for one or more Sub-Remote Units (SRUs) using the MODBUS communication protocol (RTU & ASCII modes).
	A064N	110	Tap Position Indication DTA	Translates a digital input point from a range of status points into an analog input value.
	A065N	202	CL&P DTA	The China Light and Power DTA performs miscellaneous functions as follows: Julian day/ year download, Raise/lower operations, RTS time synchronization.
	A074N	120	PML 3710 DCA	Enables the D20MX to communicate with PML 3710 ACM power meters.

License Group	D20MX Application ID	Base D20 Classic Application Version †	Application Name	Description
	A068N	311	Modbus DPA	Capable of communicating with one or more master stations using the MODBUS protocol (RTU & ASCII modes).
	A078N	610	SEL Gateway DCA for D20MX	A sub-master within a SCADA system, controlling SEL relay equipment using SEL's ASCII character-based relay protocol
	A083-0	342	Calculator DTA	Convenient and flexible soft logic utility that can perform applications such as substation level interlocking, feeder interlocking, and converting digital inputs to control outputs for driving a map board
	A088-0	203	Substation Maintenance DTA	Allows status and analog input values to be suppressed for maintenance purposes.
	A098-0N	701	Courier DCA	Enables communication with Courier SRUs (predominantly GEC K-Bus protection relays).
	A101-0N	906	IEC 870-5-101 DPA for D20MX	Communicate with one or more hosts using the IEC 60870-5-101/104 (T101) protocol. Has the ability to function as several distinct IEC 60870-5-101/104 RTUs. Supports the unbalanced version of the data link.
	A104-0N	124	Alarm Grouping DTA for the D20MX	Provides DI points each representing a group alarm. The group alarm is generated when the number of DI points in the alarm state exceed the group threshold value.
001	A113N	301	PSR DCA for D20MX	Programmable Synchrocheck Relay (PSR) DCA acts as a data concentrator for several remote PSRs. The DCA and remote PSRs function as a remote synchronous closure controller.
	A118	103	Failover DTA	Allows configurable combination of control requests to result in a failover or switchover of a redundant system.
	A121-0	200	Automatic Frequency Selection DTA	Provides AI points each derived from an Automatic Selection Method (ASM). An ASM selects the highest priority valid frequency measurement from a group of AI points.
	A123-0	111	NGC General DTA	Generates control lockout indications, digital input suppression or unsupression indications, and control active indications.
	A131-0	132	MODBUS TCP/IP DCA	Provides an interface to Sub-Remote Units (SRUs) using the MODBUS protocol over the TCP/IP communication layer.
	A135-0	110	MODBUS TCP/IP DPA	Provides communications with one or more master station using the MODBUS protocol over TCP/IP communication layer.
	A161-0	302	Secondary Master Trip/ Close DTA	Translates control requests into conventional trip/close operations in conjunction with secondary control operations to be used as a Secondary Master Trip or Close.
	A162-0	146	Internet Statistics Display	Utilizes the WESMAINT II+ application menu in order to display DNP/Internet protocol and IEC 60870-5-104 statistics.
	A184-0	120	General Alarm DTA	Takes several alarms and groups them together under one General Alarm.
001	A185-0N	303	W18979 DPA for D20MX	Emulates the Landis & Gyr 8979 RTU. Communicates with multiple master stations, over redundant communication lines.
	A186-0	213	Western Power Distribution (WPD) DTA	Calculates power from monitored voltage, current, and phase angle. Also, performs time integrated analog averaging, relative to the top of the hour.
	A193-0	302	Top of the Hour Analog Averaging DTA	Performs time integrated analog averaging, relative to the top of the hour.

License Group	D20MX Application ID	Base D20 Classic Application Version †	Application Name	Description
001	A194-0N	101	Cooper 2179 DCA	Monitors and controls Cooper devices using the Cooper 2179 protocol.
	A195-0	110	Redundant I/O DTA	Provides I/O point redundancy.
001	A199-0N	106	HR6000/XA-21 (DPA) for D20MX	Communicates with one or more hosts using the Harris HR6000/XA-21 protocol, emulating several HR6000/XA-21 LRUs. Supports multiple communication ports, multiple LRUs per communication port, and redundant porting.
	B003	751	D.20 Peripheral Link DCA	The D.20 Peripheral Link is responsible for surveillance and control of digital and analog values in the D.20 I/O peripherals.
	B008-1	311	System Point Database	Maintains the database of system points in the RTU.
	B012N	201	IRIG-B DCA for D20MX	Provides Universal Time Coordination (UTC) using the IRIG-B pulse frame, as specified by IRIG Standard 200-04 September 2004 Edition.
	B013N	560	DNP V3.00 Data Link	Provides services for software applications to send and receive messages using the Distributed Network Protocol (DNP) V3.00 Data Link protocol and the DNP V3.00 Transport Functions
	B014-1N	520	WESMAINT II+ for D20MX	RTU maintenance facility.
	B015N	530	Bridgeman	Allows applications to communicate with other peer applications. Automatically routing messages to the destination application. Intended to work within layered software architectures. Provides the routing functions of a network layer, but does not add a network layer header to outgoing messages.
	B023N	770	DNP V3.00 DCA	The Distributed Network Protocol V3.00 DCA acts as the master to one or more remote devices using the DNP V3.00 protocol.
	B034N	203	Redundant Monitor for D20MX	Monitors CCU states and initiates failover. Also, receives command requests to perform database synchronization, switchover and failover.
	B045-0	101	D20AC WESMAINT II+ Display Screens	Provides D20AC WESMAINT II+ displays
	B052-0N	351	DNP Internet Data Link for D20MX	DNP V3.00 data link over internet
	B058-0N	231	IEC 870-5 Data Link for D20MX	FT 1.2 primary data link configuration
	B060-0	210	IEC 870-5-101 DCA	Acts as a master (primary) communication device, initiating data exchanges. It is capable of sending control commands to the remote devices, and processing data autonomously collected by the data link layer.
	B071-0	200	WESMAINT File Upload	Uploads files via the WESMAINT port as S records or using ZMODEM.
	B080-0	214	IEC 60870-5-103 DCA	Monitors and controls devices using the IEC 60870-5-103 protocol.
002	B082-0N	311	LogicLinx Executor WARP for D20MX (Ethernet capable)	The LogicLinx executor is responsible for executing PLC programs written using the LogicLinx PLC (IEC 1131-3 compliant) editor.
	B085N	130	IEC Balanced Data Link	Provides services to send and receive messages using the IEC 60870-5 FT 1.2 Balanced Protocol over point-to-point links, with support for a dial-up modem. Works with one user in point-to-point configurations, or multiple users in dial-up configurations.

License Group	D20MX Application ID	Base D20 Classic Application Version †	Application Name	Description
	B086-0	131	IEC 60870-5-104 Data Link	Provides a service to reliably transfer IEC 60870-5-101 Application Service Data Units (ASDU) over a TCP/IP network. Implements this service using the transport layer interface protocol IEC 60870-5-104.
	B099-0	113	SNTP Client DTA	The Simple Network Time Protocol (SNTP) client application provides reasonably accurate and reliable time synchronization.
	B100-0	141	Internet Protocol Stack	Configuration of the LAN
	B119-1N	103	LAN Redundancy Manager	Provides health and active pseudo DI points for LAN Ports, as well as default gateway monitoring and advanced routing configuration.
	B148-0	104	Time Zone and DST Settings DTA	The Time Zone and DST (Daylight Saving Time) provides a time zone and DST information to other applications.
SAN0001 Applications				
	B009	401	Mailbox DTA	System point conversion application.
	B021N	993	DNP V3.00 DPA for D20MX	The Distributed Network Protocol (DNP) DPA enables master stations to retrieve and modify local data using the DNP V3.00 Application Layer Protocol.
SAN0002 Applications				
	B009	310‡	Mailbox DTA	Same application as used in SAN0001 except it allows you to avoid manually correcting some configuration warnings after transferring D20 firmware containing B009 versions less than or equal to 310.
	B021N	912 Φ	DNP V3.00 DPA for D20MX	Same application as used in SAN0001 except it allows you to avoid manually correcting some configuration warnings after transferring D20 firmware containing B021 versions less than or equal to 912.

Table 3 provides the License Group legend.

Table 3: D20MX license group

LIcense Group	Group Description
001	D2X Classic Applications
002	Advanced Automation Applications

The license group is an option in the D20MX order code. Refer to Table 10 and Table 11 for details. Ordering a D20MX with a particular license group option enables all applications in that group to run on the D20MX.

Table 4 lists the embedded images included in the D20MX firmware.

The **Version Image** column indicates the image versions in the SAN0001 and SAN0002 files.

Table 4: D20MX embedded images

Image ID	Image Name	Description	Version Image
S032	D20S Peripheral Board (supports B003)	D20S Peripheral Board Code	303
S033	D20A Peripheral Board (supports B003)	D20A Peripheral Board Code	301
S034	D20K Peripheral Board (supports B003)	D20K Peripheral Board Code	306
S035	D20C Peripheral Board (supports B003)	D20C Peripheral Board Code	307
S055-0	D20AC Peripheral Board (supports B003)	D20AC Peripheral Board Code	108

Firmware/FPGA versions

Refer to D20MX Release Notes (MIS-0095) available on the D20MX Documentation CD (GE part number 588-0075).

D20 device

D20 chassis

The D20 chassis is available in two versions:

- Standard single slot chassis with one horizontal Eurocard slot for mounting the D20ME/ME II board for the non-VME compatible version.
- Full VME-equipped chassis with five horizontal expansion slots for VME compatible printed circuit boards.

The D20 has a 3U horizontal slot chassis for 19" rack mounting. There are two types of chassis; see Table 5.

Table 5: D20 chassis types

Chassis Type	Part #	Description
D20 non-VME (1 slot horizontal)	500-0305	Single Slot MX Chassis with backplane, external power connections, and 7 serial I/O ports
D20 VME (5 slot horizontal)	500-0280	MX Chassis with 5 card VME backplane

D20 chassis compatibility

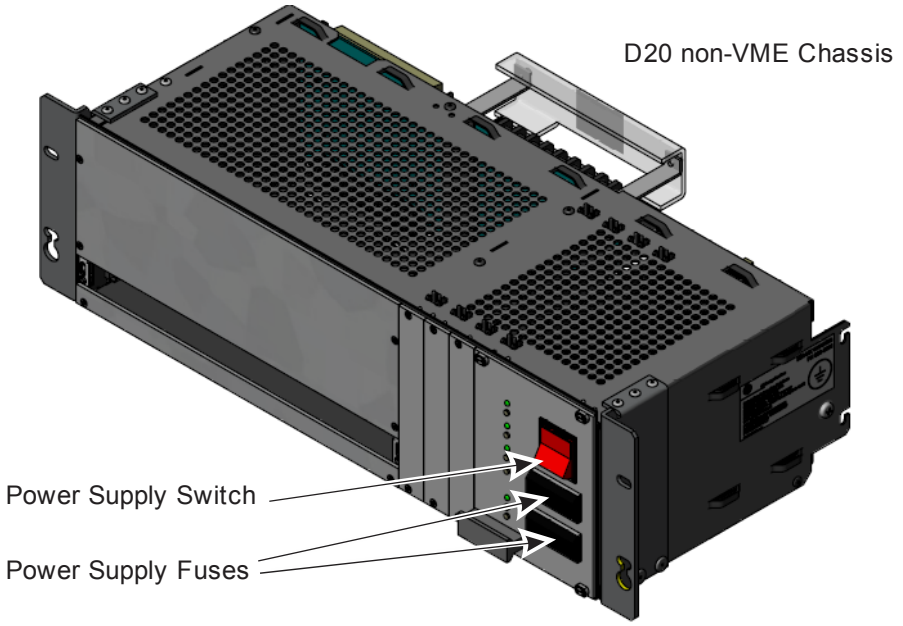
See Appendix Appendix G, *Product Combinations* on page 201, for the possible matching of main processor board and Ethernet card combinations with Chassis types.

D20 non-VME

The D20 non-VME single-slot chassis consists of the following:

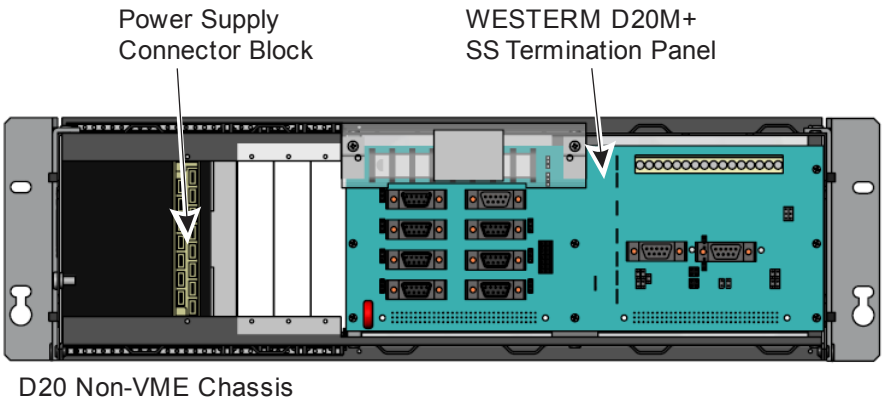
- D20MX processor board
- Modem slots
- Power supply with switch and fuses; see Figure 1.

Figure 1: D20 non-VME chassis - power supply switch and fuses



This chassis contains the WESTERM D20M+ SS termination panel, which is attached directly to the back of the assembly; see Figure 2.

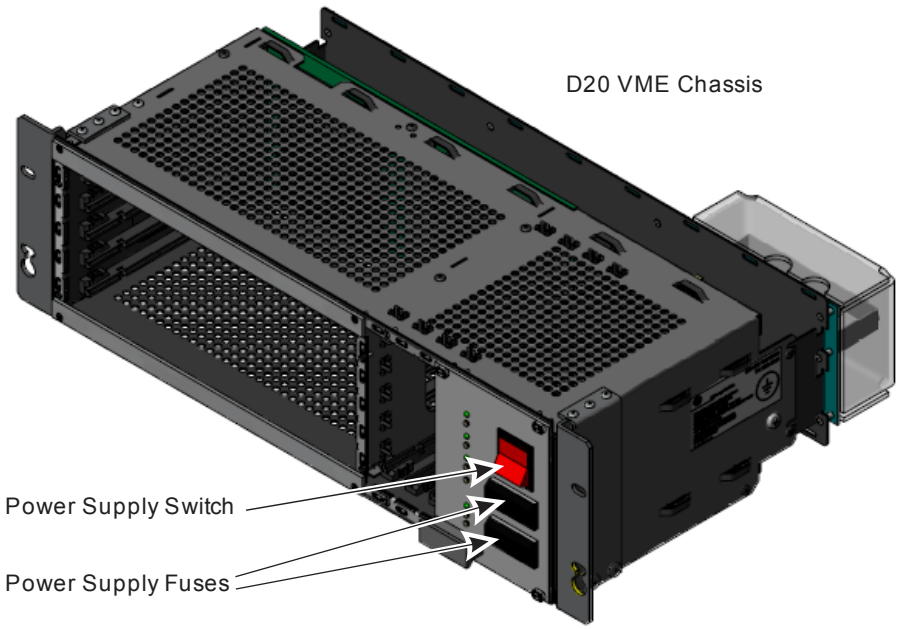
Figure 2: D20 non-VME backplane



D20 VME

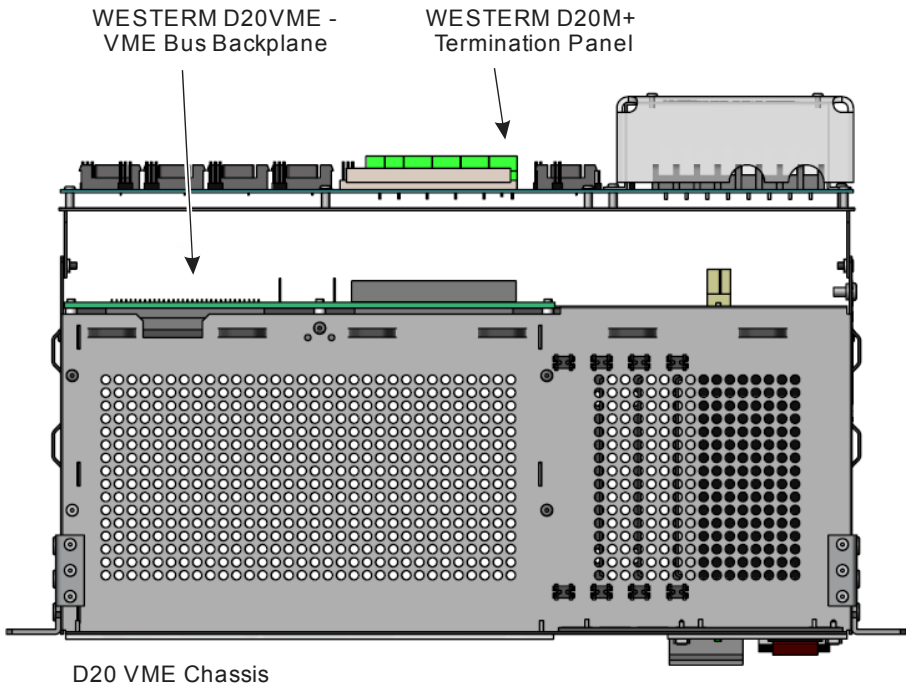
The D20 VME-compatible chassis (see Figure 3) can support one D20MX main board. When using the D20MX in a VME chassis, the 0 V ground wire must be used.

Figure 3: D20 VME chassis - power supply switch and fuses



This chassis (see Figure 4) contains the WESTERM D20M+ termination panel that is mounted separately on the D20 chassis. The VME chassis kit includes a VME bus backplane, called the WESTERM D20VME. The VME bus backplane connects to the termination panel using a ribbon cable from Slot 1 on the bus backplane.

Figure 4: D20 VME chassis - VME bus backplane and D20M+ termination panel



D20 power supply

The chassis-mounted power supply modules are switch-mode converters that provide output power for the D20MX processor board, VME cards, modems and D20 Peripheral I/O modules, as required. A redundant power supply can be installed to provide fail-over protection to ensure continuous power to the D20.

If you have an extended system with more than five peripherals, the chassis-mounted D20 power supply is not adequate. In this case, you need to install an external power supply.

The available power supplies are:

- Standard chassis-mounted; see Table 6
- Auxiliary; see Table 7
- Redundant power supplies; see Table 8

Other power supplies are available for specific requirements. Contact GE Digital Energy for details.

Table 6: Standard chassis-mounted power supplies

GE part number	Input	Output
580-2004	20 to 60 V DC	+5 V, 7 A; +12 V, 2 A; -12 V, 1 A; 24 V DC, 3 A
580-2005	20 to 60 V DC	+5 V, 7 A; +12 V, 2 A; -12 V, 1 A; 48 V DC, 1.5 A
580-2006	100 to 300 V DC or 85 to 264 V AC	+5 V, 7 A; +12 V, 2 A; -12 V, 1 A; 24 V DC, 3 A
580-2007	100 to 300 V DC or 85 to 264 V AC	+5 V, 7 A; +12 V, 2 A; -12 V, 1 A; 48 V DC, 1.5 A

Table 7: Auxiliary power supplies - rack mounted

GE part number	Input	Output	Mounting
521-0103	20 to 60 VDC	24 VDC, 75 W	Rack mounted
521-0104	100 to 300 VDC	24 VDC, 75 W	Rack mounted
521-0105	90 to 250 VAC	24 VDC, 75 W	Rack mounted
521-0106	100 to 350 VDC	48 VDC, 120 W	Rack mounted
521-0107	90 to 250 VAC	48 VDC, 120 W	Rack mounted

Table 8: Redundant power supplies

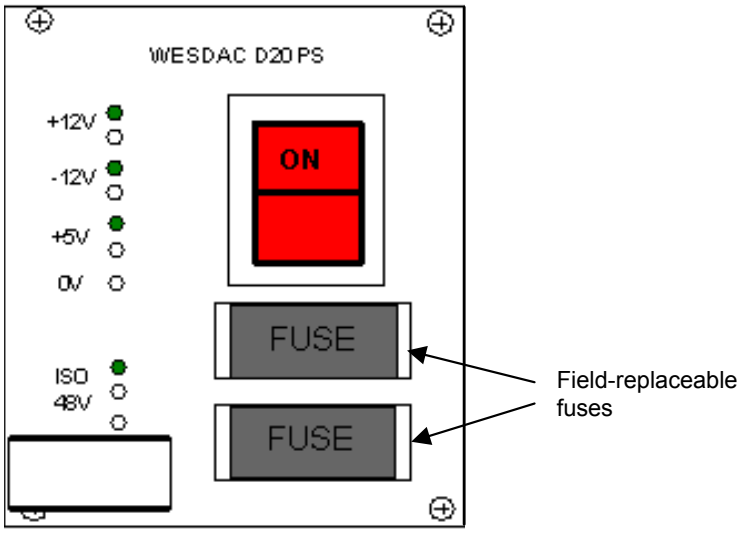
GE part number	Input	Output	Mounting
580-0719	110 VAC or 125 VDC	24 VDC	
580-0741	220 VAC or 48 VDC	48VDC	
580-0789	110 VAC or 48 VDC	48 VDC	
510-0241	115 VAC + 15% or 30 to 60 VDC	48 VDC, 2.5 A	Rack mounted
510-0242	115 VAC + 15% or 40 to 144 VDC	48 VDC, 2.5 A	Rack mounted

NOTICE

Over-current protection: Ensure your D20 power input is externally protected for over-current; otherwise damage to the D20MX may occur. The required fuse rating depends on the power consumption of your system.

The D20 available power supplies, listed in Table 6 are equipped with two field replaceable fuses.; see Figure 5.

Figure 5: D20 - Location of field-replaceable fuses



Field-replaceable fuses for the standard chassis-mounted Power Supplies are listed in Table 9. These are the standard factory-installed fuses, unless otherwise specified. Always replace with the same type and values of fuse.

Table 9: Field-replaceable fuses

Power Supply	Fuse	Fuse Function	**Replacement Fuse (¼inch by 1 ¼ inch Time Delay)**
580 - 2004	F1	+DC Input	12 A / 250 V
	F2	-DC Input	12 A / 250 V
580 - 2005	F1	+DC Input	12 A / 250 V
	F2	-DC Input	12 A / 250 V
580 - 2006	F1	Line/+DC Input	4 A / 250 V
	F2	Neutral/-DC Input	4 A / 250 V
580 - 2007	F1	Line/+DC Input	4 A / 250 V
	F2	Neutral/-DC Input	4 A / 250 V

Modems

D20 modems (can be purchased separately) for communications to a host computer or to other IEDs.

For example, WESDAC 202/V.23 is a 1200-baud Bell 202 or CCITT V.23 standard modem designed for 300 to 1200 baud asynchronous operation on unconditioned lines and supports the majority of SCADA/EMS applications. The 3U (GE part number 520-0120) vertical mount configuration in the D20 chassis and the 19 inch rack mount (GE part number 520-0090) version are currently not supported.

Third-party modems can be used to meet specific requirements. These modems are connected to the D20 via standard RS-232 connections. Contact GE Digital Energy for more information on options.

NOTE

If using a dial-up modem or high speed leased line modem, you must ensure the D20MX port baud rate does not exceed the speed of the modem to modem link.

NOTE

If using a switched-carrier modem on a port, and retries have increased after upgrading from a D20ME to a D20MX, ensure Receive Squelch (also called DCD Wait, DCD Delay, Receive Inhibit Time, or DCD to RX Enable Time) is configured in the serial application that uses the port. Refer to the configuration guide of the serial application for further details.

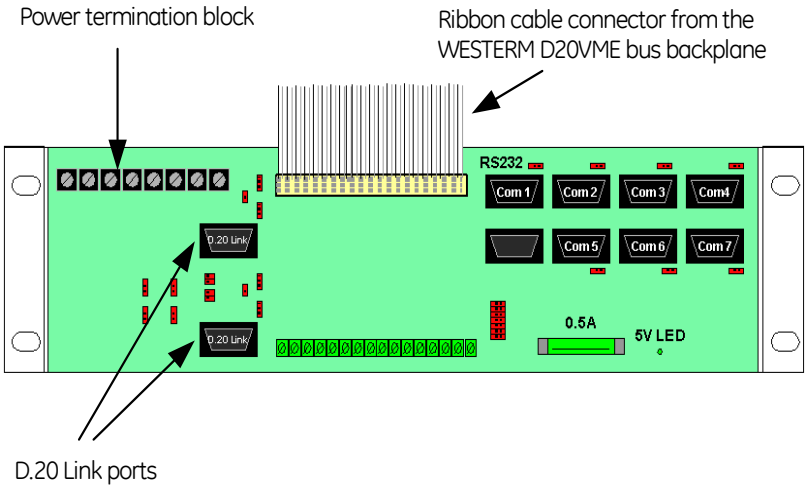
WESTERM D20M+ termination panel

Three methods may be used to mount the WESTERM D20M+ termination panel.

Method 1

With the standard chassis the WESTERM D20M+ termination panel (see Figure 6) is mounted separately into the 19" standard rack on a 2U mounting plate.

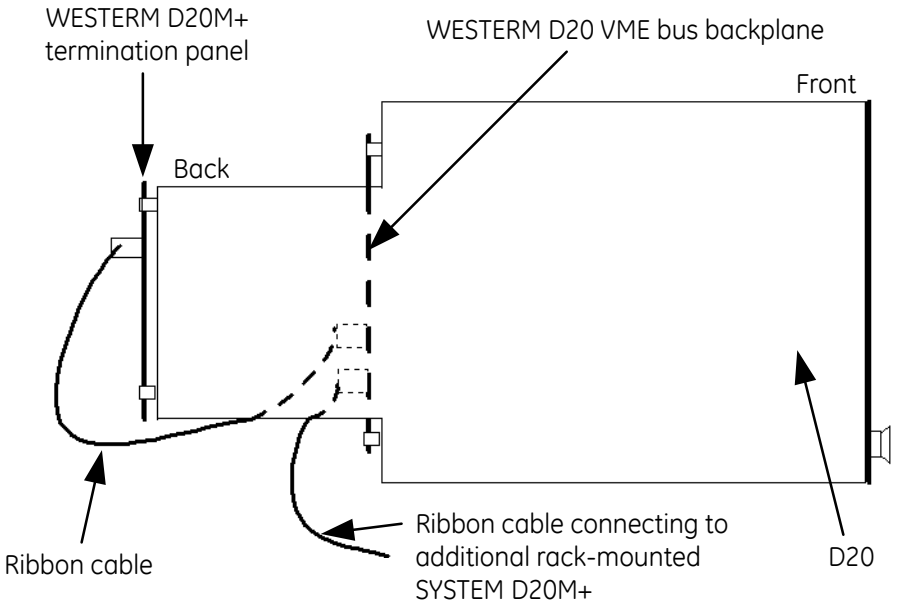
Figure 6: WESTERM D20M+ termination panel - back view - connections



Method 2

With the MX chassis the WESTERM D20M+ termination panel (see Figure 7) is mounted behind the WESTERM D20VME bus backplane. This leaves more room on the rack for multi-node installations.

Figure 7: WESTERM D20M+ termination panel - MX chassis side view - connections



Method 3 For the D20MX processor there is also an option to use an extended bracket for chassis mounting.

Ordering guides

The latest ordering guides are available on the GE Digital Energy website:

http://www.gedigitalenergy.com/multilin/energy/catalog/D20MX.htm

You can select the required options from the available Product Option items. The Order Code automatically updates as each option is selected.

The ordering guides are available in the following tables:

- "D20 - D20MX order codes" on page 31
- "D20MX upgrade kits order guide" on page 32

D20 - D20MX substation controller ordering guide

Table 10: D20 - D20MX order codes

D20MX CPU Options	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(A) - D20MX non-VME, dual 10/100/1000BASE-TX Ethernet Ports (front access)		A												
(C) - D20MX non-VME dual 100BASE-FX ST Ethernet Ports (front access)		C												
(G) - D20MX non-VME, dual 100BASE-FX Ethernet Ports (rear access)		G												
D20MX Power Supply	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(A) - D20 Power Supply, 20-60VDC Input, 24V ISO Output			A											
(B) - D20 Power Supply, 20-60VDC Input, 48V ISO Output			B											
(C) - D20 Power Supply, 100-300VDC/85-264VAC Input, 24V ISO Output			C											
(D) - D20 Power Supply, 100-300VDC/85-264VAC Input, 48V ISO Output			D											
D20MX Modem slots 1, 2 & 3	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(U) - Empty slot with cover plate				U	U	U								
(C) - Telenetics 14400 baud modem 2-wire dial up				C	C	C								
(D) - Telenetics 14400 baud modem 4-wire leased line				D	D	D								
(E) - D20MX dual 100BASE-FX ST Media Interface Card				E										
(F) - D20MX dual 100 BASE-FX LC Media Interface Card				F										
D20MX Serial Termination Panel Options	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(A) - 19" Rack Mount Serial IO Westerm Panel						A								
(B) - D20 Chassis Mounted Serial IO Westerm Panel						B								
(C) - D20 Chassis Mounted Serial IO Westerm Panel w/Extended Bracket						C								
D20MX Firmware Options	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(**) -D20MX firmware (Refer to the GE Digital Energy online store for available firmware options)							*	*						
D20MX D2X CLASSIC Applications License	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(U) - Not required									U					
(A) - D2X CLASSIC APPLICATIONS									A					
D20MX ADVANCED AUTOMATION Applications License	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(U) - Not required										U				
(B) - ADVANCED AUTOMATION APPLICATIONS										B				
FUTURE Feature	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(U) - Not required											U			
FUTURE Feature	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(U) - Not required													U	
D20MX Serial Expansion	**D20MX**	**-***	*	*	*	*	*	*	*	*	*	**U**	**U**	*
(U) - Not required														U
(A) - 7 additional ports (14 ports total. 1x 19" Rack Mount Serial IO Westerm Panel included). See Note below.														A
(B) - 14 additional ports (21 ports total. 2x 19" Rack Mount Serial IO Westerm Panel included). See Note below.														B
(C) - 21 additional ports (28 ports total. 3x 19" Rack Mount Serial IO Westerm Panel included). See Note below.														C

NOTE

The 19" Rack Mounted Serial IO Westerm Panel included with the Serial Expansion options must be installed directly below the D20 chassis.

D20MX upgrade kits

Table 11 provides the available D20MX upgrade kits and spare kit (D20MX CPU only) Order Guide. Order the SGConfig Setup Software DVD (GE part number 588-0082) if required.

Table 11: D20MX upgrade kits order guide

D20MX Kit Type	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(A) - Upgrade Kit for D20 Horizontal chassis		A									
(D) - Upgrade Kit for D20 Horizontal chassis - Single Slot		D									
(C) - D20MX CPU only		C									
(E) - Serial Expansion only for D20 Horizontal chassis		E									
D20MX CPU Options	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(U) - Not required			U								
(A) - D20MX non-VME, dual 10/100/1000BASE-TX Ethernet Ports (front access)			A								
(C) - D20MX non-VME dual 100BASE-FX-ST Ethernet Ports (front access)			C								
(G) - D20MX non-VME, dual 100BASE-FX Ethernet Ports (rear access)			G								
D20MX Media Interface Card Options	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(U) - Not required				U							
(E) - D20MX dual 100BASE-FX ST Media Interface Card				E							
(F) - D20MX dual 100 BASE-FX LC Media Interface Card				F							
D20MX Firmware Options	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(**) -D20MX firmware (Refer to the GE Digital Energy online store for available firmware options)					*	*					
D20MX D2X CLASSIC Applications License	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(U) - Not required							U				
(A) - D2X CLASSIC APPLICATIONS							A				
D20MX ADVANCED AUTOMATION Applications License	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(U) - Not required								U			
(B) - ADVANCED AUTOMATION APPLICATIONS								B			
FUTURE Feature	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(U) - Not required									U		
FUTURE Feature	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(U) - Not required											
D20MX Serial Expansion	**D20MXK**	**-***	*****	*****	*****	*****	*****	*****	**U**	**U**	*****
(U) - Not required											U
(A) - 7 additional ports (14 ports total)											A
(B) - 14 additional ports (21 ports total)											B
(C) - 21 additional ports (28 ports total)											C

The Serial IO Westerm panel is not included with Serial Expansion in the kits.

Specifications

The D20MX adheres to the following system, communications, electrical, physical and environmental specifications. Additional Standards and Protection are listed in Appendix B, *Standards & Protection*.

Processor

Processor	667 MHz embedded PowerQUICC II Pro
Memory	1024 MB of 266 MHz DDR2 RAM with ECC 16 MB NVRAM for persistent event storage
Storage	8 MB boot flash 256 MB firmware flash
Operating system	VxWorks
LED indicators	System status: Power, Ready Ethernet port status: Link and Activity status per port Power supply: Power IRIG: Flashes when active.

Communications

Network connections	Dual redundant Ethernet interface Twisted Pair 10/100/1000BaseT (Isolated RJ-45 connector) 100BaseFX (Fiber Optic: 1300 nm, 50/125 µm, 62.5/125 µm multi-mode duplex fiber cable, ST connectors)
Serial communications	**D.20 Link, 2 channels** Data rate: 250 kbps Surge protected to ±2000 V peak **RS-232, 7 channels** 5-signal (TXD, RXD, RTS#, CTS#, DCD#) DTE ports Data rate: independently-selectable; refer to the application configuration guides.
Maintenance Port	RS-232, 1 channel/ 2 ports 2-signal (TXD, RXD) Data rate: 9600 (or 19200 bps)

Electrical (D20 horizontal chassis)

Rated power supplies	**AC-DC**	100 to 240 V AC (±10%) 143 W output maximum Minimum/Maximum AC voltage: 90 V AC / 265 V AC 100 to 300 V DC (±10%) 143 W output maximum Minimum/Maximum DC voltage: 88 V DC / 330 V DC
	DC-DC	20 to 55 V DC (±10%) 135 W maximum Minimum/Maximum DC voltage: 18 V DC / 60 V DC
Peak inrush current at 25 °C on cold start	**AC-DC**	50 A, max at 230 V AC
	DC-DC	50 A, max at 230 V AC
Rated frequency (AC-DC)	50/60 Hz nominal (47 to 63 Hz)	

Physical (D20 horizontal chassis)

Overall height	40.34 mm (1.588 in.)
Width	261.87 mm (10.31 in.)
Depth	160 mm (6.3 in.)
D20MX weight	0.7 kg (1.65 lb)
Fiber card weight	0.2 kg (0.35 lb)
Battery shipping restrictions	The D20MX does not contain a battery and is therefore not affected by US DOT or ICAO shipping restrictions.
Material/Finish	Galvannealed steel with black power coat
Kit package	Length: 49.5 cm (19.5 in.) Width: 34.3 cm (13.5 in.) Height: 15.2 cm (6 in.) Weight: 2.54 kg (5.6 lb)

Environmental

Operating temperature	0°C to +70°C **Note:** Do not operate the D20MX above 60°C for extended periods of time as this shortens the life of the super capacitor and reduces the backup time of the real time clock.
Humidity rating	5% to 95% relative humidity, non-condensing
Environmental rating	Ingress protection: IP30 (IEC 60529)
Installation / overvoltage category	CAT II (2)
Pollution degree	2
Use	Indoor use only
Operating altitude	Maximum altitude 3000 m [9480 feet] above sea level
MTBF (MIL-HDBK-217): D20MX processor board	Non-VME with 10/100/1000BASE-TX copper: 449,616 hours at 40°C Non-VME with 100BASE-FX fiber optic: 265,657 hours at 40°C

Software

Configuration	Performed using SGConfig 8.5 and higher

Storage recommendations

Storage conditions

Always store the D20MX in an environment compatible with operating conditions. Recommended environmental conditions for storage are:

- Temperature: -40 °C to +85 °C
- Relative humidity: 5% to 95%, non-condensing
- Maximum altitude: 12192 m [40,000 feet] above sea level

Do not store the D20MX above 60°C for extended periods of time as this shortens the life of the super capacitor and reduces the backup time of the real time clock.

When powered off, the D20MX real time clock remains active for 14 days at -40°C to 60°C, and greater than one month at 25°C. Information in the NVRAM remains stored indefinitely since flash memory is used.

D20MX Substation Controller

Chapter 2: Installing the D20 Substation Controller

This chapter covers the following topics:

- Required tools and materials
- Installation procedure - D20 Substation Controller
- Rack installation
- D20 chassis layouts

Required tools and materials

Before beginning the installation procedures, have the following tools and equipment available:

- Flathead screwdriver with 0.6 x 3.5 mm blade (for terminal block wiring)
- #2 Phillips screwdriver (for rack mounting the unit)
- Wire cutters (for field wiring)
- Wire strippers (for field wiring)
- Wire crimping tool (for field wiring)
- Tie-wraps (for organizing wiring and cables)
- Multimeter (for testing voltages and I/O points)
- Needle nose pliers (for setting jumpers, for example)
- PROM puller (only required if you are going to be upgrading or installing PROMs in the field)
- Labelling device to label cables and wires

Installation procedure - D20 Substation Controller

To install the D20 Substation Controller:

1. Unpack the system components and report any damage.
   1.1. Carefully remove the D20 Substation Controller from its packaging.

1.2. Open the product package and check that the following items have been delivered:
   - Chassis
   - Main processor board
   - Power supply
   - WESMAINT maintenance port cable
   - Software loaded into the D20MX Substation Controller, See "Configuring the Software" on page 75.
   - Termination panel: Based on the order code will be either be; 19" Rack mount, D20 Chassis Rear Mount or D20 Chassis Rear Mount Extended.
   - Modems (options for the Main Chassis kit).

1.3. Visually inspect the unit to ensure it has not sustained any visible damage during transit. If there are visible signs of damage, *report it immediately to the carrier*. Contact GE Digital Energy Technical Support to return the D20 Substation Controller; see section: "Product returns" on page 10.

1.4. Verify that you have received all items. GE parts include a unique number, typically in the format XXX-XXXX, that can be used as a reference.

2. Mount the D20 Substation Controller.
3. Perform all field wiring connections and jumper settings. See section: "Connecting to Devices and Networks" on page 53.
4. Connect the power supply to the D20 chassis.
5. Power-up the D20 Substation Controller and check for normal operation. See section: "Powering-up and Testing a D20 Substation Controller" on page 69.

   Some testing requires that code and configuration files have been downloaded to the D20 Substation Controller.
6. Start using the D20MX's tools and utilities to configure and monitor the operation of the D20MX. See "Using the D20MX Substation Controller" on page 107.

Rack installation

Rack spacing for free airflow

When mounting multiple D20s in a rack (or if mounting a D20 in a rack with other equipment) verify that there is at least one rack unit (RU) of space above and below the D20 to allow for cooling airflow (1 RU = 1.75 inches).

D20 chassis layouts

Your D20 Substation Controller can comprise one of three D20 chassis layouts; see "Installation procedure - D20 Substation Controller" on page 37.

The D20 non-VME chassis front panel layouts for the D20MX upgrade kits comprise:

- A D20 containing a D20MX with front Ethernet connectors; see Figure 8.
- A D20 containing a D20MX with front Fiber Optic connectors; see Figure 9.
- A D20 containing a D20MX with rear Fiber Optic connectors; see Figure 10.

Figure 8: D20 chassis front panel - D20MX with Ethernet connectors

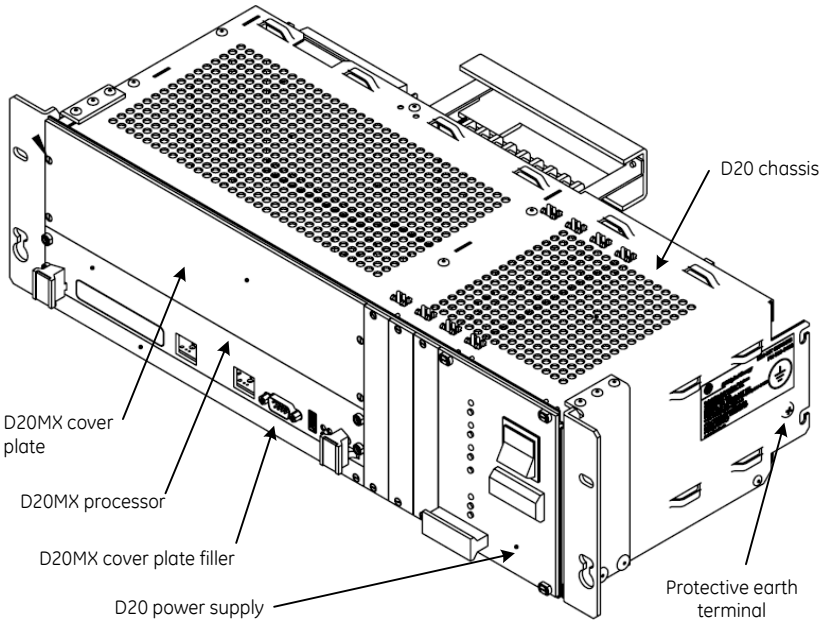


Figure 9: D20 chassis front panel - D20MX with front fiber optic connectors

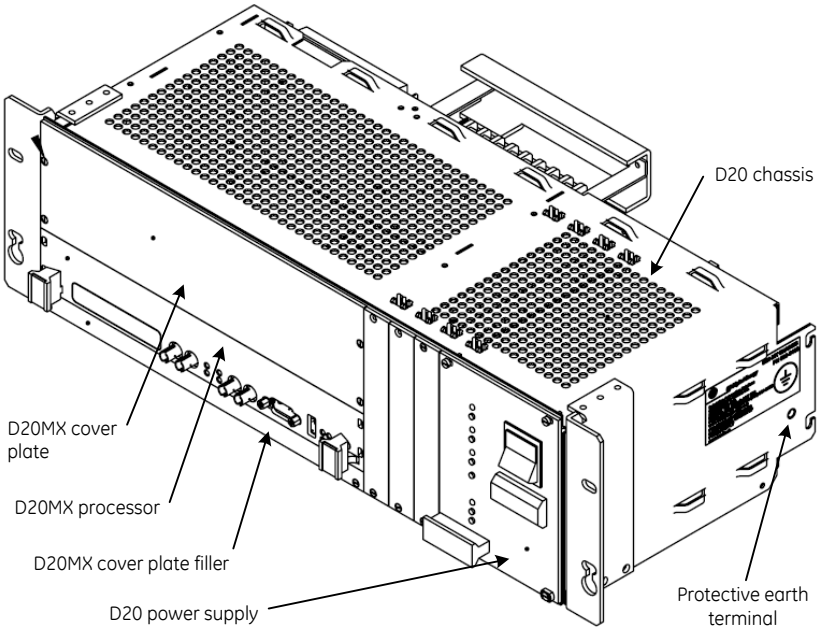
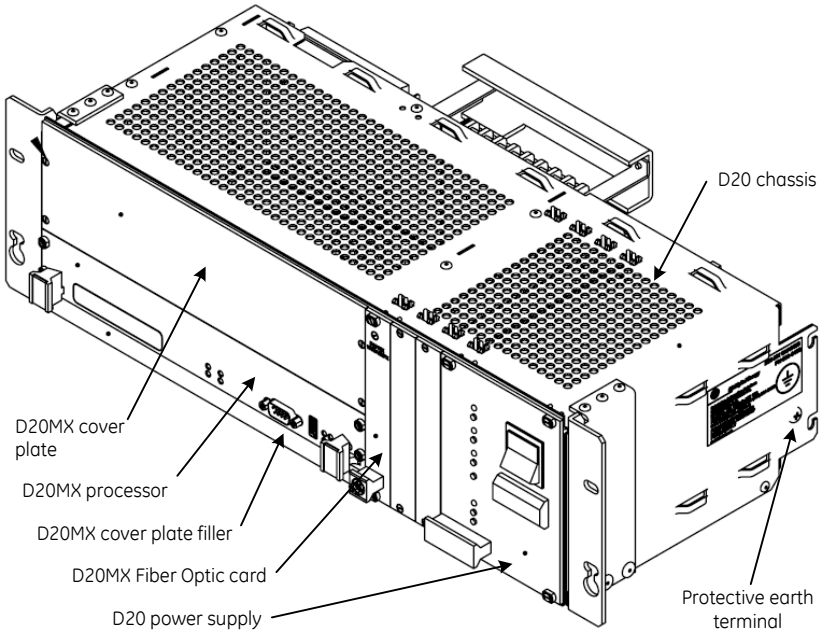


Figure 10: D20 chassis front panel - D20MX with rear fiber optic connectors



D20MX Substation Controller

Chapter 3: Retrofitting the D20MX in an Existing D20 Chassis

This chapter covers the following topics:

- Required tools and materials
- Retrofit procedure - D20MX processor into a D20
- Unpacking and inspecting the D20MX
- D20 chassis layouts
- Connecting the power supply to the D20MX
- Grounding theD20MX

The D20MX processor board can be installed in an existing D20 device to replace D20ME D20M++, or D20MEII processor boards. If a D20 is being retrofitted, the following limitations exist:

- You cannot install multiple D20MX processor boards in a single D20. If more than seven serial ports are required, you must purchase a Serial Expansion kit. See section: “D20MX upgrade kits” on page 32.
- The D20MX supports 100BASE-FX instead of 10BASE-FL. If you are using any other devices in your system, and you are limited to 10BASE-FL, you must purchase a 100BASE-FX to 10BASE-FL media converter.

The D20MX can be installed in a VME chassis or a non-VME chassis.

See section: “D20MX upgrade kits” on page 32 for a list of available upgrade kits and the parts provided within each kit.

Required tools and materials

Before beginning the installation procedures, have the following tools and equipment available:

- Appropriate device cables for D.20 connections (GE part number 977-0089)
- For D20MX Non-VME with Dual 10/100/1000Base-TX (part number 526-3001): CAT5 network cables for RJ-45 Ethernet connections (GE part number 977-0280 or equivalent)

- For D20MX Non-VME with Dual 100Base-FX (part number 526-3003) and D20MX Non-VME with Dual 100Base-FX Fiber Optic Card (part number 526-3005): multi-mode duplex fiber cable - ST connectors.
- Flathead screwdriver with 0.6 mm by 3.5 mm blade (for terminal block wiring)
- #1 Phillips screwdriver (for panel or DIN rail mounting the unit)
- #2 Phillips screwdriver (for rack mounting the unit)
- Needle-nose pliers
- Wire cutters
- Wire strippers
- Approved network settings for the device
- Windows-based PC with any Windows-based terminal emulation software and Web browser software installed
- 12 AWG wire (minimum) for protective earth
- 2 ring connectors, Panduit part number PV10-14R for 12 AWG [3.3 mm^2] wire for protective earth terminal

Retrofit procedure - D20MX processor into a D20

To retrofit the VME chassis and the non-VME chassis:

1. Unpack the system components and report any damage. See section: "Unpacking and inspecting the D20MX" on page 50.
2. Ensure that you are sufficiently grounded to prevent ESD damage to the D20MX or other components. See section: *"Grounding the D20MX" on page 52*.
3. Remove the D20MX from its static-protective packaging. Set the packaging aside and save it for future reuse.

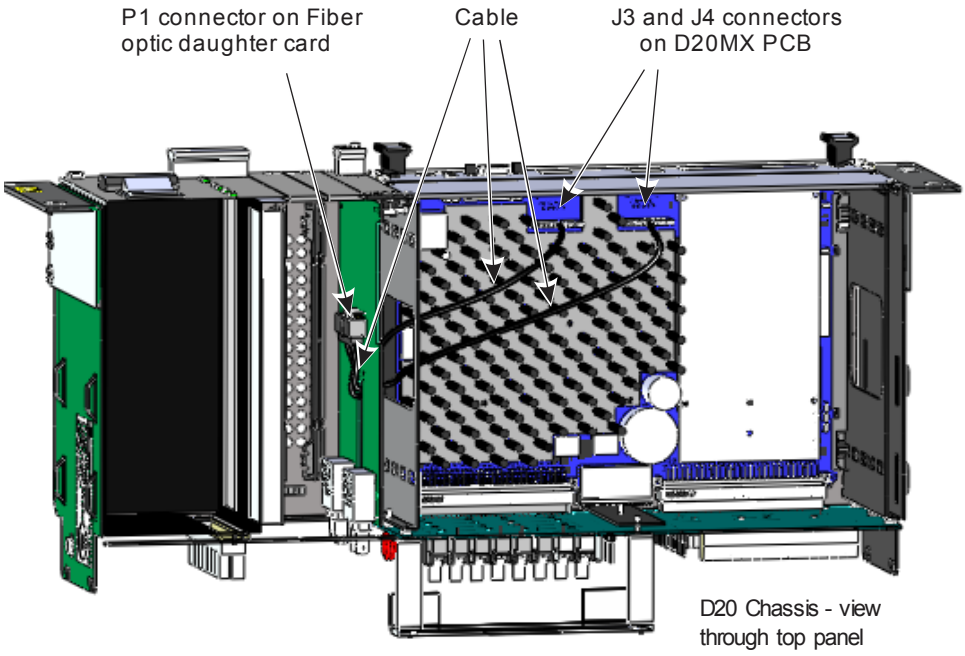
The D20MX must be placed on an anti-static surface while not installed in the chassis.

Handle the D20MX with care, since SMT components are located on the bottom side.

4. Switch the power off for the D20 chassis.
5. Prepare an ESD safe work area and ensure you are sufficiently grounded.
6. Remove the D20ME, D20M++, or D20ME II module.
7. Remove the D20EME module and D20EME Media Interface Card.
8. Remove the filler plate below the D20MX processor and the blanking faceplate above the D20MX processor.

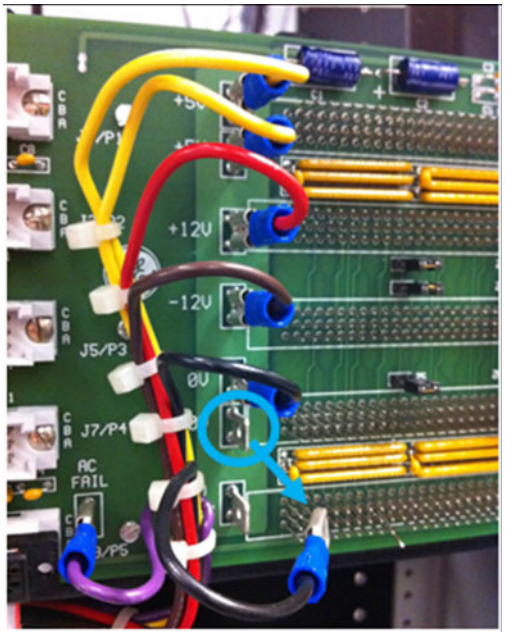
9. If the D20MX is rear fiber access type, install the Media Interface Card in Modem slot 1:
   9.1. Move a previously installed modem to Modem slot 2.
   9.2. Install the D20MX Media Interface Card in Modem slot 1. Ensure that the cable is not pinched. See *Figure 11, "Cable to fiber optic daughter card"*.

Figure 11: Cable to fiber optic daughter card



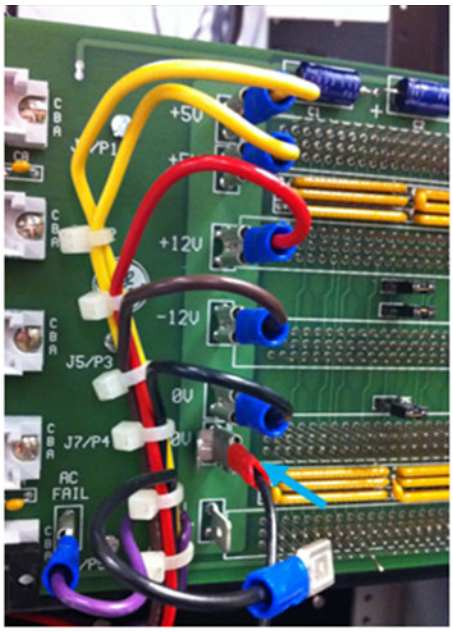
10. If the D20MX is being installed in a VME chassis, connect the 0V+GND cable (GE part number 975-1239):
   10.1. Remove the original 0V cable from the 0V terminal on the backplane; see *Figure 12*.

Figure 12: D20 - remove original 0 V cable



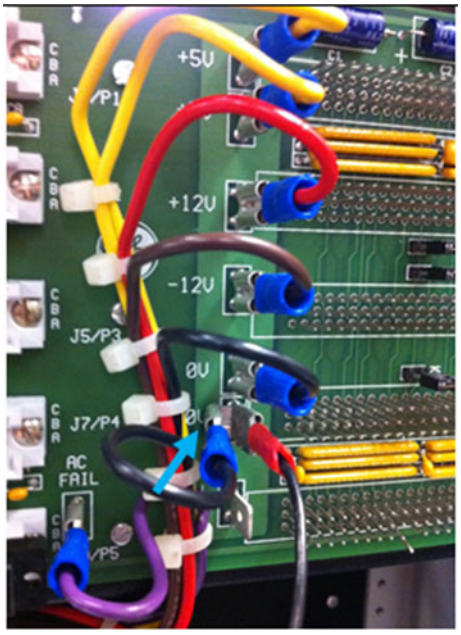
10.2. Insert the piggy-back connector of 975-1239 to the 0V terminal; see *Figure 13*.

Figure 13: D20 - install 975-1239



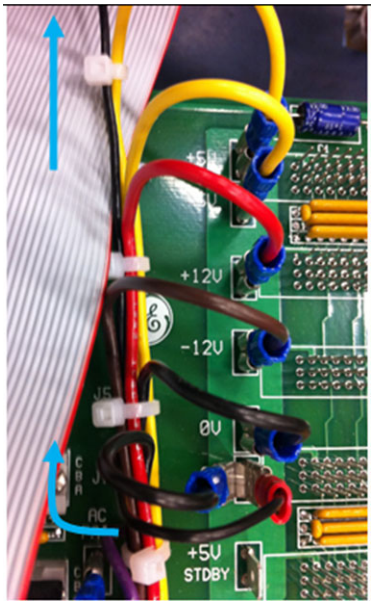
10.3. Re-install the original 0V cable to the 975-1239 piggy back terminal; see *Figure 14*.

Figure 14: D20 - re-install original 0 V cable



10.4. Route the 975-1239 cable to exit at the top of the chassis; add cable ties to secure the wire bundle; see *Figure 15*.

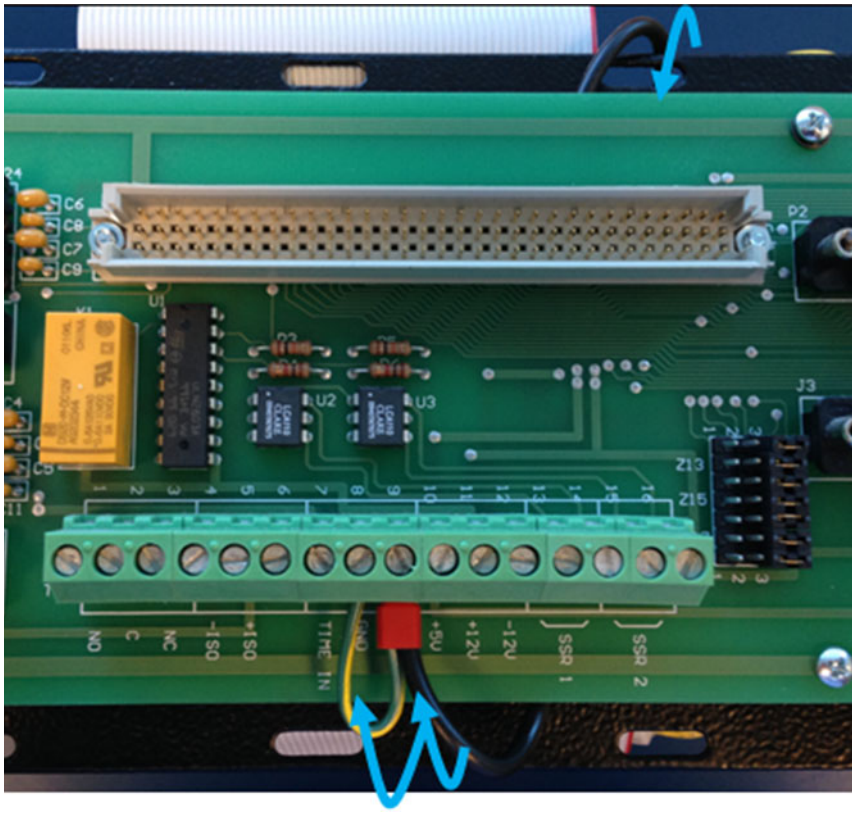
Figure 15: D20 - route from 0 V terminal up to top



10.5. Route the 975-1239 cable over the rear extension bracket, behind the Termination Panel PCBA, and connect to the Termination Panel.

See *Figure 16*.

Figure 16: D20 - connect to TB2-8 and TB2-9



10.6. Insert the ferrule (with two wires) end of 975-1239 into position 9 of TB2 and tighten the screw terminal.

10.7. Insert the Green wire with stripped end of 975-1239 into position 8 of TB2 and tighten the screw terminal.

11. If the D20MX requires Serial Expansion, install the Serial Expansion processor:

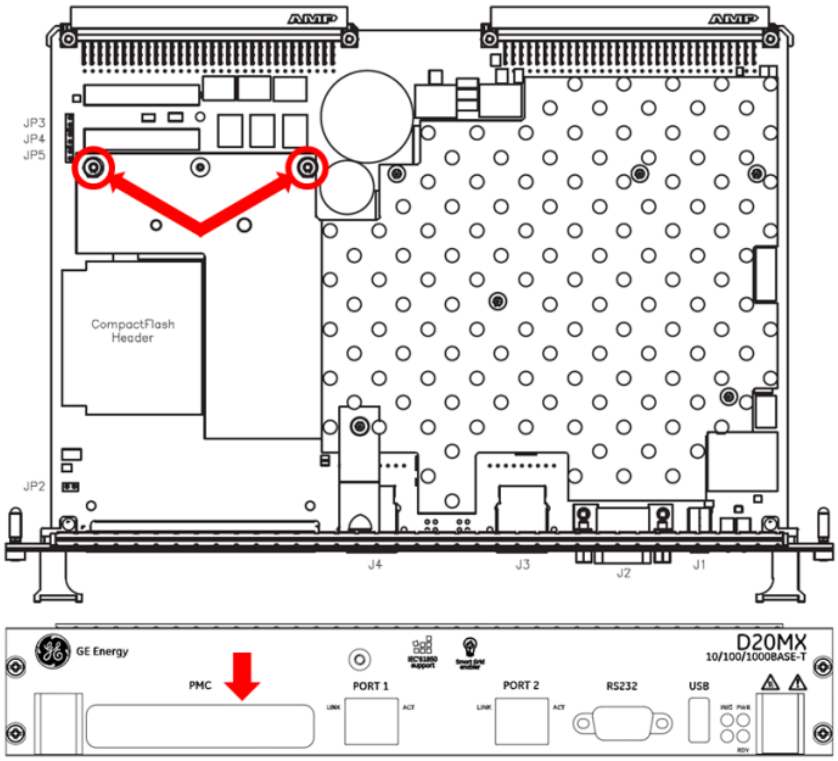
11.1. Use a Torx #T8 screw driver and a 5mm nut driver to remove the 2 screws with nyloc nuts at the PCM site on the D20MX.

NOTE

The PCB assemblies include small sensitive electronic components. Take care when removing and installing screws and nuts near to these components.

11.2. Remove the PMC filler plate from the D20MX faceplate; see *Figure 17*.

Figure 17: Remove PMC filler plate



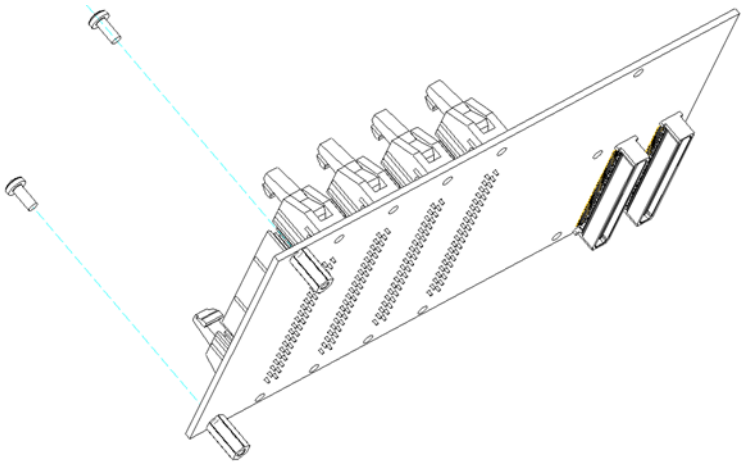
11.3. Remove the D20MX Serial Expansion Processor from its static-protective packaging and locate the hardware kit (2 stand-offs and 4 screws) attached to the packaging.

11.4. Install the two stand-offs to the D20MX Serial Expansion Processor with the 2 screws supplied; see *Figure 18*.

NOTE

The 2 remaining screws will be required to secure the Serial Expansion Processor to the D20MX.

Figure 18: Serial expansion processor with stand-offs



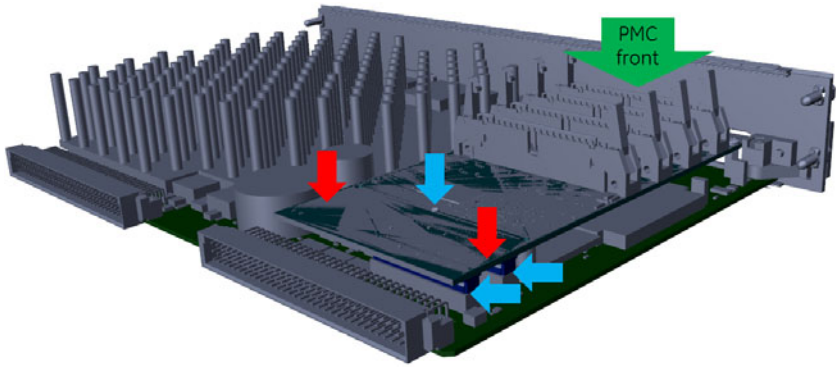
11.5. Align the 2 PMC connectors and the center alignment pin on the SE Processor with the D20MX.

11.6. Support the front of the SE Processor and firmly mate the SE Processor to the D20MX; see *Figure 19*.

NOTE

The PCB assemblies have SMT components mounted on both sides of the assembly and caution must be taken when resting on table surface and during the installation process.

Figure 19: Serial expansion processor - install on D20MX processor



11.7. Install the Torx #T8 screws and 5mm nyloc nuts removed in step 11.1. The screws are inserted from the bottom of the D20MX and the nuts are secured on top of the SE Processor.

NOTE

The PCB assemblies include small sensitive electronic components. Take care when removing and installing screws and nuts near to these components.

11.8. Install the 2 remaining screws from the kit into the stand-offs at the front of the PMC. The screws are inserted from the bottom of the D20MX.

11.9. Inspect the PMC connectors and confirm they are fully seated.

11.10. Install the PMC filler plate removed in step 11.2.

12. Install the D20MX in Processor slot 1 and tighten the front panel retaining screws to 3.5 in-lbs to secure the D20MX to the chassis.
13. If the D20MX requires Serial Expansion, install the Serial Expansion auxiliary cards:
    13.1. Confirm that all levers on the 40 pin connectors (both on the Processor and Auxiliary card) are in the open position.
    13.2. Orient the interconnect cable with pin 1 (indicated by the blue marker) to the right. The connector at the top will have the locating feature facing upwards. Insert top connector into the Auxiliary card.
    13.3. Install Serial Expansion Auxiliary card into the appropriate Processor slot with the appropriate interconnect cable length.
        13.3.1. Use the PCB handles on the SE Auxiliary card to hold the assembly firmly and align with the card guide rails in the chassis.

NOTE

Ensure the card properly aligns with the rails for a smooth installation. A slight angle will cause the card to catch on the rails and jam.

        13.3.2. Use the bottom handle to push and the inner handle to guide the PCB assembly.
        13.3.3. Once fully inserted, push on both handle to fully seat the PCB assembly into the backplane
    13.4. Install the lose connector of the interconnect cable into the appropriate header on the SE Processor.
    13.5. Repeat step 13 for additional Serial Expansion Auxiliary card using table below

SE Auxiliary card	Processor slot	Cable length	SE Processor header	SGConfig port name
1	3	3 inches	P1	CB1 to CB7
2	4	5 inches	P2	CC1 to CC7
3	5	5 inches	P3	CD1 to CD7

Depending on the Upgrade kit options selected; 1, 2, or 3 auxiliary cards can be installed in the D20 system. Figure 20 shows the Serial Expansion processor header designations.

Figure 20: Serial expansion processor - header designations

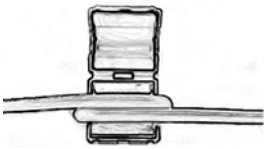
14. Install the lower filler plate (GE part number 953-1015) below the D20MX processor.
15. Install the upper blanking faceplate (GE part number 953-1035) above the D20MX processor.

NOTE

The rubber pads on the inside surface of the blanking faceplate must align with the PCB handles on the SE Auxiliary card.

16. Install the ferrite clamp included in the package to the power inlet cable:
    16.1. Ensure that you are sufficiently grounded to prevent ESD damage to the D20MX or other components.
    16.2. Remove ferrite clamp (GE part number 460-0073) from the package; handle with care as the magnetic material is fragile.
    16.3. Pass the power cable through the channel, approximately 15 cm (6 inches) from the connector on the chassis.
    16.4. Loop the power cable one more time around and through the core; see *Figure 21*.

Figure 21: Open ferrite clamp



    16.5. 15.5. Close the core and snap the halves together; see *Figure 22*.

Figure 22: Closed ferrite clamp

    16.6. 15.6. Visually inspect the installation and confirm that the assembly has completely latched and that the power cable is not pinched. Also check that none of the power cable connections have come loose during the installation process.
17. Connect the power to the D20MX. Refer to section: "Connecting the power supply to a D20MX" on page 51.
18. Connect ground to the D20MX. Refer to section: "Grounding the D20MX" on page 52.

Unpacking and inspecting the D20MX

To unpack and inspect the D20MX:

1. Unpack the system components and report any damage.
2. Carefully remove the D20MX from its packaging.
3. Open the product package and check that the following items have been delivered:
   - D20MX unit (GE part number 526-3001, or 526-3003, or 526-3005)
   - For 526-3005LF only:
     - D20MX to Fiber Card Harness (975-1236)
     - D20MX 100BASE-FX Rear LC FO Card (part number 526-3103LF) or D20MX 100BASE-FX Rear ST FO Card (part number 526-3104LF)
   - Lower filler plate (part number 953-1015)
   - Blank plate for D20MX install (part number 953-1014)
   - 0 V wire cable (part number 975-1237)
   - For 526-3005LF installed in 500-0280 only:
     - Termination Panel, D20MX extended mounting (952-2087)
   - GE Digital Energy Product Documentation CD (GE part number 581-0002)
   - GE Digital Energy D20MX Documentation CD (GE part number 588-0075 VXX)
4. Visually inspect the unit to ensure it has not sustained any visible damage during transit. If there are visible signs of damage, *report it immediately to the carrier.*
5. Verify that you have received all items. GE parts include a unique number, typically in the format XXX-XXXX, that can be used as a reference.

D20 chassis layouts

Installation of the D20MX can be performed with one of three D20 chassis layouts; see “D20 chassis layouts” on page 38.

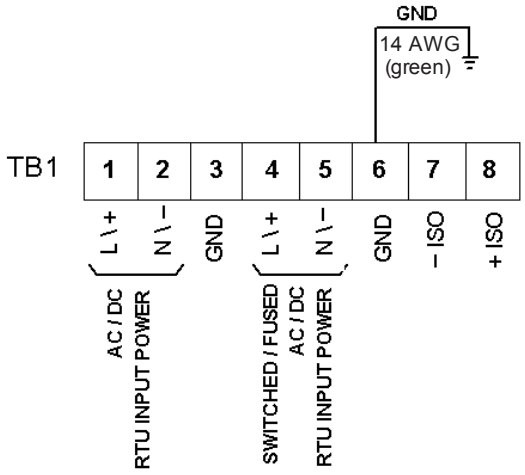
Connecting the power supply to a D20MX

The D20MX processor board is supplied power through the WESTERM D20M+ SS backplane. Power connections to the backplane are made on connector block TB1.

For the WESTERM D20M+ SS and WESTERM D20M+ (see Figure 23, "WESTERM D20M+SS: power supply connections") the power supply connections:

- 1 and 2 are used for input power connections based on the D20 power supply
- 4 and 5 can be used as a switched auxiliary power supply source
- 7 and 8 can be used externally for status wetting, contact wetting and/or miscellaneous power connections, if applicable.

Figure 23: WESTERM D20M+SS: power supply connections



Grounding the D20MX

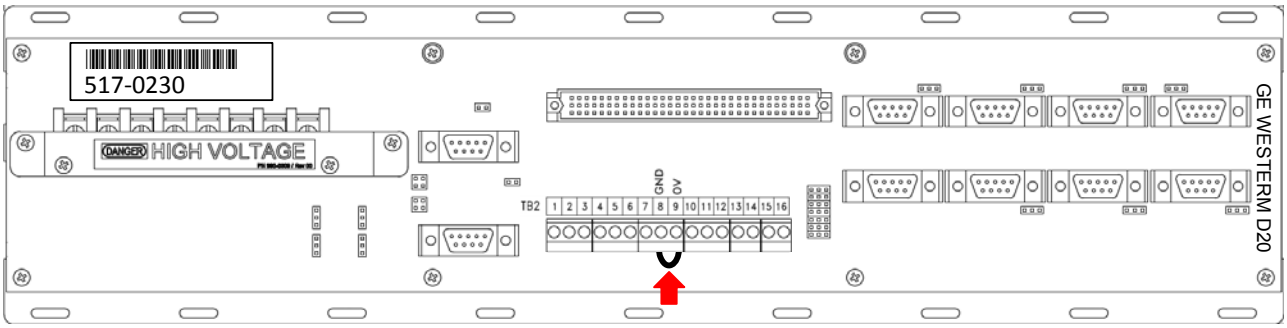
Surge and noise suppression components used on the D20MX are designed to prevent nuisance operation and damage to internal components. To ensure correct protective operation, the earth ground wire (14AWG green wire) on the D20 chassis must be connected to a low impedance ground rail of a secondary cabinet or rack.

When making ground connections, ensure that all surfaces that are used for grounding are free of dirt, residue and corrosion.

NOTICE

An electrical surge or ESD event can damage the D20MX processor. To prevent damage to the D20MX, connect the earth ground to the signal ground on the terminal block (TB2) located on the WESTERM Termination Panel. The earth ground terminal is position 8 on TB2 and the signal ground terminal is position 9 on TB2. For example, see the VME WESTERM Termination board in *Figure 24, "VME WESTERM termination panel - earth ground and signal ground connection"*. In cases where two wires are required to be connected to a single terminal, a two-wire ferrule should be used.

Figure 24: VME WESTERM termination panel - earth ground and signal ground connection



D20MX Substation Controller

Chapter 4: Connecting to Devices and Networks

This chapter provides guidelines for making physical connections between the D20 and substation and network devices.

Cabling overview

All physical connections are made to the connectors on the rear backplane of the D20 chassis or to the front on the D20MX processor module.

D20MX front panel connectors

The D20MX front panel can have one of the following layouts:

- Ethernet connectors (RJ45); see Figure 25.
- Front access Fiber optic connectors (ST); see Figure 26.
- Rear access Fiber optic connectors on a fiber optic daughter card; see Figure 27. The optic daughter card can be either a D20MX dual 100 BASE-FX ST Media Interface Card or a D20MX dual 100 BASE-FX LC Media Interface Card.

For a description of the operational status LEDs and port status LEDs, see "D20MX processor front panel LEDs " on page 107.

Figure 25: D20MX front panel with Ethernet connectors

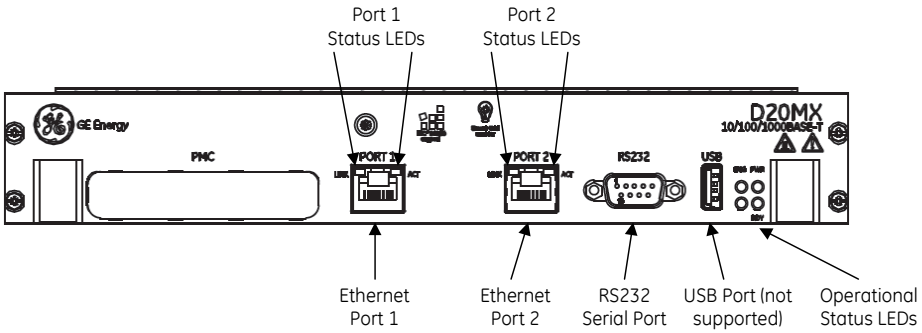
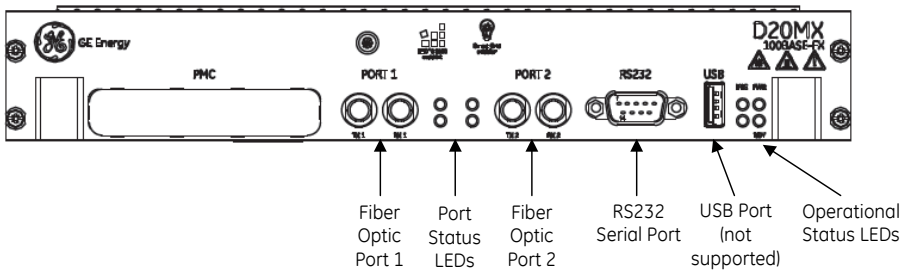


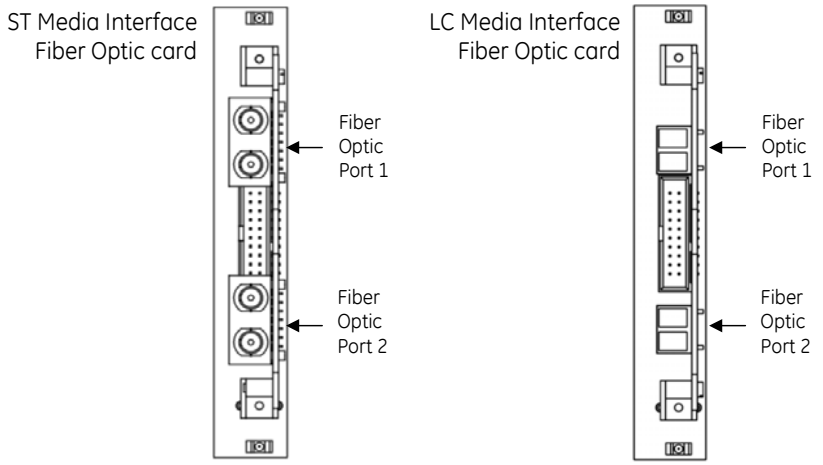
Figure 26: D20MX front panel with front access fiber optic connectors



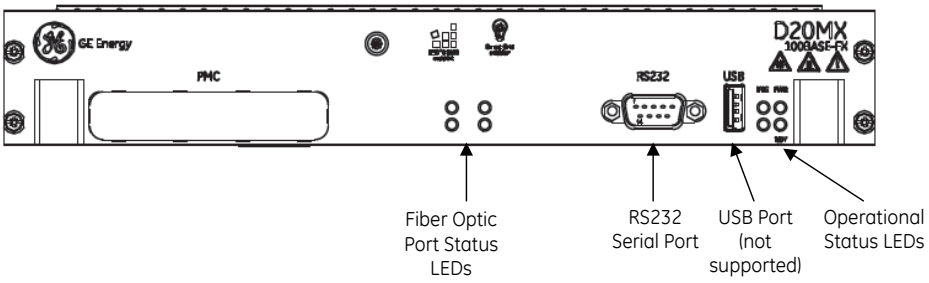
The D20MX can be used with an ST connector Fiber Optic card or an LC connector Fiber Optic card.

Figure 27: D20MX front panel and fiber optic card with rear access fiber optic connectors

D20 chassis back view –
Either an ST or LC connector Media Interface Card



D20MX front panel



General cabling requirements

Table 12 lists the cables required to connect to the D20MX:

Table 12: Connection cables

Media	Designation	Cabling	Connector
Serial	RS-232	Shielded	DB-9 female
D.20 Link	RS-485 2 wire	Shielded	DB-9 female
Twisted Pair Ethernet (GE part number 526-3001 only)	10/100/1000BASE-T	UTP (Unshielded Twisted Pair) – CAT 5 or better	RJ-45
Fiber optic (GE part number 526-3003 and 526-3005LF only)	100BASE-FX	1300 nm, 50/125 µm and 62.5/125 µm multimode duplex fiber cable	ST-style connectors

To provide higher EMC immunity and maintain CE Mark radiated emission compliance, the serial cables used for permanent serial and D.20 Link connections must comply with the following requirements:

- Cables must be shielded
- D-type connector covers must provide EMC shielding (e.g. metallized plastic or die cast metal covers).

Serial

Seven serial communications ports are brought out to the backplane connector P2. These serial ports are five-signal (TXD, RXD, RTS#, CTS#, DCD#) DTE serial ports, compliant to ANSI/TIA-232 and TIA/EIA-694 specifications and are hosted by UARTs.

The D20MX is tested with all 7 serial ports running at 19200 baud with 20% CPU utilization. Refer to application configuration guides for supported baud rates and for data bits.

NOTICE

To avoid burning out the WESTERM or D20MX mainboard when directly connecting a rear-panel serial port on one D20MX chassis to another rear-panel serial port on any type of D20 chassis, jumper the WESTERM of both chassis' to not provide a power connection to pin 4. Refer to the appropriate WESTERM module layout for jumper settings.

D.20 Link

Communications between the D20 and the D20 peripheral I/O modules are carried over a high-speed, high-level data link control (HDLC) protocol called the D.20 Link. The D.20 Link has the following features:

- RS-485 serial link, half duplex, 250 kbps
- D.20 frame using HDLC protocol format with Manchester encoding
- Supports up to 38 D20 I/O peripheral modules in a standard configuration

Media options:

- RS-485, 24 AWG twisted pair, for applications up to 330 meters
- Multi-Mode Glass Fiber (GFO), up to 2 km
- Plastic Fiber (PFO), up to 60 meters

If you are using the D20 as a Master Data Concentrator, then the D.20 Link connectors are not used.

The D.20 Link can also be used to supply power to peripherals on smaller D20 horizontal slot chassis systems. Power supply to the WESDAC/WESTERM peripheral pairings is through the WESTERM boards. For details, see the *D20/D200 Installation and Operations Guide* (part number 994-0078); see section: *Connections and Configuration*.

Second D.20 link

Redundant D.20 communication channels are available on all peripherals. Daughter boards are required to support this functionality:

- Part number: 540-0207, for the A, S and K boards
- Part number: 540-0209 for the C board

D.20 communications interface

Use the D.20 Communication Interface module when you require one-to-one communication links with peripherals.

D.20 splitter

Use the D.20 Splitter when you require one-to-four communication links with peripherals, especially if peripherals are clustered in different areas of the substation.

D.20 RS-485 interface

The D.20 RS-485 Interface provides the repeater function, which can only be implemented on the D.20 Communications Interface.

GFO and PFO adaptors

Glass Fiber Optic (GFO) and Plastic Fiber Optic (PFO) adaptors are used to provide either glass or plastic fiber optical cable extensions to the D.20 Link. These allow interference free links to peripherals that are sited at a remote distance from the main D20 installation.

Extended power

When power requirements for multiple peripherals exceed the base system limitations, use the D.20 DC Interface module.

D.20 DC interface

The D.20 DC Interface module is used:

- As power input for additional peripherals on a D.20 Link

Interposing relays

The required rating of the relays on the K and C boards is determined by the loading characteristics of the device that the boards control.

If the load rating of the controlled device exceeds the K or C board relay rating, then you need an Interposing Relay panel.

Universal Protocol Converter

A Universal Protocol Converter (UPC) is required when the D20 has to communicate with a device that uses a synchronous communications format. The function of the UPC is to convert between the D20's asynchronous format, and the device's synchronous format.

Peripherals

Peripheral I/O modules are intelligent modules containing an on-board microprocessor. They are configured as slaves to the D20MX processor board. In this way, specific I/O processing is distributed throughout the RTU to the appropriate I/O module.

There are five types of I/O peripherals:

- D20A analog input
- D20S digital inputs
- D20K digital output
- D20C combination input/output
- D20AC alternating current analog input

Optional high-voltage peripherals are also available.

The D20MX is only compatible with certain peripheral common code (i.e., pcommon) versions as defined in Table 13.

Table 13: Peripherals compatible with the D20MX

I/O peripheral	PCOMMON version compatibility	PERFPAL version compatibility
D20C	P022 - PCOMMON2: • 3.05, 3.00 are compatible • 2.21 and earlier are NOT compatible	PERFPAL 3 1.2 with OLD Base setting is compatible PERFC 00 with NEW Base setting is compatible
D20A, D20S and D20K	P010 - PCOMMON: • 3.06, 3.05, 3.01, 3.00 are compatible • 2.21 and earlier are NOT compatible	PERFPAL 1 1.5 with OLD Base setting is compatible PERFASK 00 with NEW Base setting is compatible
D20AC	P087 - pBOOT 1.04, 1.03, 1.02 are compatible	-

For further information on I/O peripherals, see the *D20/D200 Installation and Operations Guide* (part number 994-0078); see section: *Connections and Configuration*.

Twisted-pair Ethernet (for 526-3001 only)

The10/100/1000BASE-T variant of the D20MX can connect to one or two networks through two twisted-pair Ethernet connections. In redundant LAN mode this causes the two Ethernet connections to use the same MAC address. Port 1 is the primary port and Port 2 is the secondary port. When the system detects a signal on Port 1, Ethernet traffic takes place on Port 1. When the system detects loss of signal on Port 1, Ethernet traffic takes place on port 2.

All RJ-45 connectors have the same signal definition. However, the twisted-pair Ethernet ports are auto MDI/MDIX and can support a straight-through or crossover cable.

NOTE

The D20MX does not require Ethernet switches to use Spanning Tree Protocol (STP), but for switches configured to use STP, you must configure the switch ports that are connected to the D20MX as edge ports.

To connect the D20MX to network devices

Plug network cables into the D20MX twisted-pair Ethernet ports.

NOTE

If the D20MX is deployed in the presence of strong RF energy in the 110 MHz - 125 MHz band, such as airport ILS localizers or aviation radio transmitters, it is recommended that shielded twisted-pair Ethernet cables be used.

Table 14: Ethernet RJ-45 connector signal definitions

Position	Function	Signal Flow	Color
1	RX+	IN	White w/ Orange
2	RX-	IN	Orange
3	TX+	OUT	White w/ Green
4	P1+	-	Blue
5	P1-	-	White w/ Blue
6	TX-	OUT	Green
7	P2+	-	White w/ Brown
8	P2-	-	Brown
	Shield	-	-

Table 15: Ethernet crossover cable (RJ-45) pin out

D20MX		Switch/Hub	
Name	Pin	Pin	Name
TX_D1+	1	3	RX_D2+
TX_D1-	2	6	RX_D2-
RX_D2+	3	1	TX_D1+
RX_D2-	4	2	TX_D1-
BI_D3+	5	7	BI_D4+
BI_D3-	6	8	BI_D4-
BI_D4+	7	4	BI_D3+
BI_D4-	8	5	BI_D3-

Table 16: Ethernet straight-through cable (RJ-45) pin 0ut

D20MX		PC	
Name	**Pin**	**Pin**	**Name**
TX_D1+	1	1	RX_D2+
TX_D1-	2	2	RX_D2-
RX_D2+	3	3	TX_D1+
RX_D2-	4	4	TX_D1-
BI_D3+	5	5	BI_D4+
BI_D3-	6	6	BI_D4-
BI_D4+	7	7	BI_D3+
BI_D4-	8	8	BI_D3-

Fiber optic Ethernet (for 526-3003 and 526-3005LF only)

The 100BASE-FX variant of the D20MX (GE part numbers 526-3003 and 526-3005) can connect to one or two networks through two fiber-optic Ethernet connections.

The data rate on each port is 100 Mbps.

NOTE

You must enable Far End Fault Indication (FEFI) or Loss Link Alert (LLA) in connected external devices for proper redundant operation.

NOTE

External switches must have Spanning Tree Protocol port settings configured to edge for proper operation of 100Base-FX connected ports.

You can use the following glass optical fiber (GOF) cabling with the D20MX:

- 50/125 µm core/cladding multi-mode (gradient index) cable
- 62.5/125 µm core cladding multi-mode (gradient index) cable
- 100/140 µm core/cladding multi-mode (gradient index) cable
- 200 m core Hard-Clad Silica (HCS) multi-mode (step index) cable

You can use the following fiber optic terminations for D20MX cabling:

- ST Connectors (with 526-3003 and 526-3005LF + 526-3104LF fiber card)
- LC connectors (with 526-3005LF + 526-3103LF fiber card)

When calculating cable length, consider the following optical power levels:

- Glass optical fiber transmitter power is –19.0 ± 2 dBm
- Glass optical fiber receiver sensitivity is typically –25.4 dBm

⚠CAUTION

This product contains components rated as Class 1 Laser Products.

LAN redundancy

Both twisted-pair and fiber optic Ethernet options provide two LAN redundancy schemes called redundant LAN and dual LAN.

The redundant LAN scheme provides automated fail over between two Ethernet network connections (TX1/RX1 and TX2/RX2) that share a single MAC address.

When the primary port (that is, port 1) receives no signal, or detects a fault signal from the remote link partner, the D20MX switches to the secondary port (that is, port 2) if it has a valid link. The D20MX reverts to the primary port if the primary link is restored or no signal is present on the secondary port.

With the dual LAN scheme, each port has a unique MAC, IP address and subnet. Each remote device participating in a dual LAN scheme must have a primary IP address reachable through the LAN A subnet of the D20MX and a secondary IP address reachable through the LAN B subnet of the D20MX. D20MX client applications fail over to the remote device's secondary IP address when they detect a failure to communicate with the remote device's primary IP address. D20MX server applications accept communications from the remote device's primary or secondary IP address.

To configure a system for redundant LAN operation, enable only LAN A in the device properties of the D20MX. To configure a system for redundant LAN operation with an Alias IP, enable both LAN A and LAN B in the device properties of the D20MX and set the “Redundancy” field in the B119-1N LAN Redundancy Manager > LRM Configuration table to “Redundant LAN”. An Alias IP allows the D20MX to communicate with devices using the dual LAN scheme and devices using the redundant LAN scheme, simultaneously.

To configure a system for dual LAN operation, enable both LAN A and LAN B in the device properties of the D20MX and set the “Redundancy” field in B119-1N LAN Redundancy Manager > LRM Configuration table to “Dual LAN”. The D20MX device properties and the B119-1N LAN Redundancy Manager configuration may be configured through SGConfig 8.1 and higher.

IP addresses

The D20MX assigns IP configuration to its LAN A and optionally LAN B interface according to the rules defined in Table 17.

In a standalone system, the D20MX assigns the LAN A and LAN B IP addresses exactly as you configured them in SGConfig.

In a redundant system, the D20MX assigns the LAN A and LAN B IP addresses of the Active CCU exactly as you configured them in SGConfig.

However, in other modes, the CCU assigns derived IP addresses as indicated in Table 17. For a description of the modes, refer to Table 19. The D20MX assigns the subnet mask of the derived IP addresses as the subnet mask configured in the LAN A or LAN B configuration.

Table 17: D20MX IP address assignment

CCU	Redundant System	Mode	LAN A IP Configuration	LAN B IP Configuration (If Configured)
CCU A	Standalone	Active, Debug or Disabled	**IP Address**: LAN A IP Address **Mask**: LAN A Subnet Mask (e.g 192.168.1.1 / 255.255.255.0)	**IP Address**: LAN B IP Address **Mask**: Configured LAN B Subnet Mask (e.g. 192.168.2.1 / 255.255.255.0)
CCU A	Redundant	Active		
CCU B	Redundant	Active		

CCU	Redundant System	Mode	LAN A IP Configuration	LAN B IP Configuration (If Configured)
CCU A	Redundant	Standby, Debug or Disabled.	**Derived IP Address**: LAN A IP Address + 1 **Mask**: LAN A subnet mask (e.g. 192.168.1.2 / 255.255.255.0)	**Derived IP Address**: LAN B IP Address + 1 **Mask**: LAN B subnet mask (e.g. 192.168.2.2 / 255.255.255.0)
CCU B	Redundant	Standby, Debug or Disabled.	**Derived IP Address**: LAN A IP Address + 2 **Mask**: LAN A subnet mask (e.g. 192.168.1.3 / 255.255.255.0)	**Derived IP Address**: LAN B IP Address + 2 **Mask**: LAN B subnet mask (e.g. 192.168.2.3 / 255.255.255.0)
CCU A/B	Redundant or Standalone	Service Mode	Not enabled	Not enabled

You may override or disable the derived IP address by defining a host with the desired IP address. Use an IP address of 0.0.0.0 to disable the derived IP address. Define the host in the SGConfig tool > D20MX Device Wizard > Define the LAN properties for this project screen (see Figure 28 for an example).

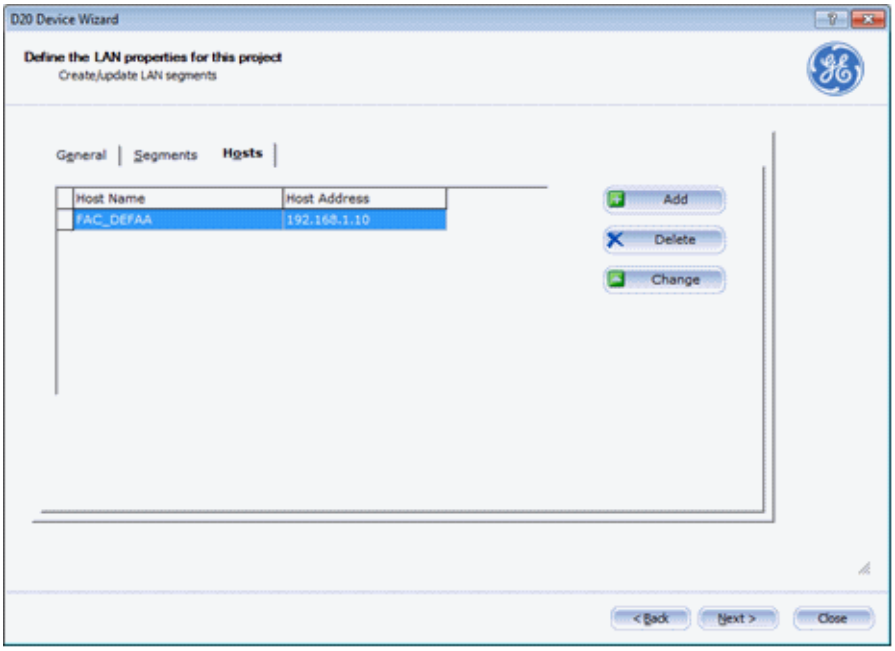
NOTE

When transferring a redundant D20 in a ConfigPro or SGConfig project configuration to a D20MX ensure the new D20MX standby IP addresses do not conflict with other devices in the project. If they do, you may disable the standby IP addresses or reassign them as described in the previous paragraph. If there are any conflicts, the WESMAINT error log of the D20MX will log warnings such as the following:

1 ROOT N0: W001: IP of RDT1 same as CCUB

where RDT1 is the host name of the device with a conflicting IP address.

Figure 28: SGConfig - example of overriding derived IP address by defining a hostname



Each host consists of a host name and host address. Construct the host name by replacing the last two characters of the D20MX Host Name with a two character suffix that matches the derived IP address you wish to override or disable. The suffix conventions are shown in Table 18. The D20MX Host Name appears in the D20MX Device Wizard as shown in Figure 29.

Figure 29: SGConfig - Host name shown in the LAN Settings

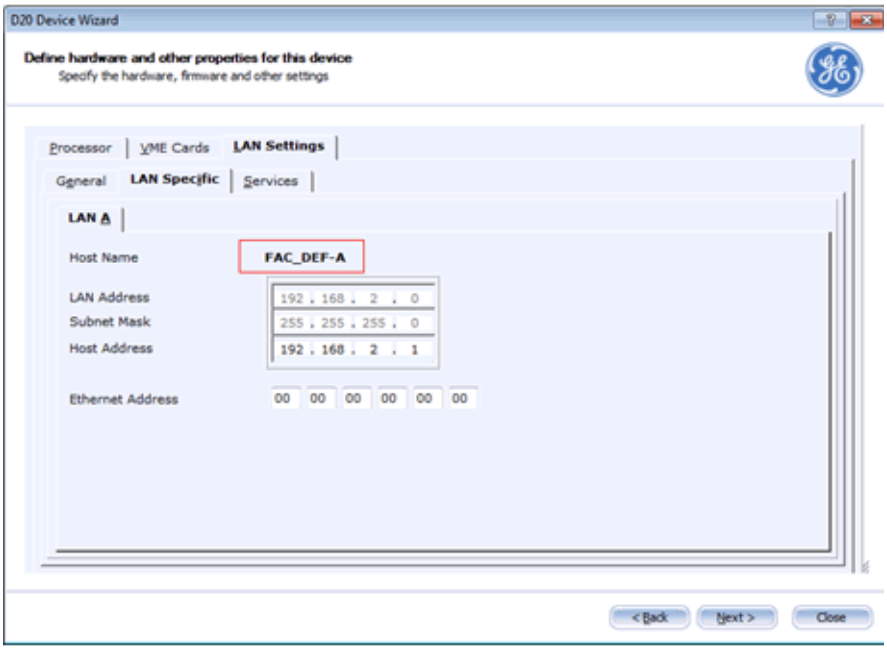


Table 18: Host name suffix conventions

HostName Suffix	IP Address Corresponds To...	Example
AA	CCU A, LAN A	FAC_DEFAA
AB	CCU A, LAN B	FAC_DEFAB
BA	CCU B, LAN A	FAC_DEFBA
BB	CCU B, LAN B	FAC_DEFBB

The D20MX can be in one of five modes as defined in Table 19. You can find the current mode of the D20MX by navigating to the SHELL in WESMAINT II+ and typing the command **el**.

Table 19: System mode definitions

Mode	Description	Partial "el" output
Active	D20MX applications are operational.	`Active CCU YES`
Standby	D20MX applications are not operational but are ready to take over on a switchover command or a failover.	`Standby CCU YES`
Disabled	D20MX applications have been suspended due to an error. You must type **el /r** and **boot** in the SHELL to clear this error.	`Disabled YES`

Debug	D20MX boot sequence has been interrupted by pressing **CTRL-E**. Put the CCU into this mode in order to recover a system that has a corrupted configuration or code image.	`Redundant CCU NO`
		`Standby CCU NO`
		`Active CCU NO`
		`Service Mode NO`
		`Sys Service Mode NO`
		`Disabled NO`

Service Mode	D20MX configuration has been corrupted or is in the process of receiving a new configuration. To recover the system, you must download a configuration serially.	`Service Mode YES`

RS-232

The RS-232 port on the D20MX is used to access the WESMAINT II+ facility and to transfer code and configuration data to the D20MX. You can use a VT100-compatible terminal or terminal emulation program to directly access the WESMAINT II+ facility. SGConfig's Terminal Emulator is an example of a suitable terminal emulation program.

For convenience the RS-232 port (COM0) is connected to the D20MX front panel and to the rear panel. Only one port can be connected to at a single time, since both connectors are internally connected to a single UART.

The D20MX can be ordered from the factory with either 9600 or 19200 bps. To change the baud rate of the RS-232 port to 19200, type **JBAUD 19200** in the D20M SHELL. To change the baud rate to 9600 type **JBAUD 9600** in the D20M SHELL.

NOTICE

Only a single connection at one time can be made to either the front panel RS-232 port or to the rear panel WESMAINT port.
Connecting to both the front panel RS-232 port and the rear panel WESMAINT port at the same time potentially results in faulty system operation and damage to the D20MX and the connected computer.

NOTE

JBAUD requires that you login as a user whose "Monitor Access Level" is Read/Write (i.e., Administrator role).

Non-responsive RS-232 port

In the event that the D20MX RS-232 port appears non-responsive, type **Ctrl-Q**. This non-responsive condition might occur if your computer goes into sleep mode and then wakes up while still connected to the D20MX RS-232 port.

NOTICE

Use only a NULL modem cable (GE Digital Energy part number 977-0529) when you are connecting to the D20MX front-panel RS-232 connector. Use of a WESMAINT cable does not allow communication to the D20MX.

NOTICE

Use only a standard WESMAINT cable (GE Digital Energy part number 977-0300) when connecting to the rear panel COM0 connector. Use of a NULL modem cable causes permanent damage to the D20MX and PC.

D20 Gateway system redundancy

A redundant D20 setup allows a secondary D20 to automatically take over operations from a paired D20 unit that has failed.

D20 equipment redundancy requires:

- Two D20 units and
- One or two RS-232 switch panels.

NOTE

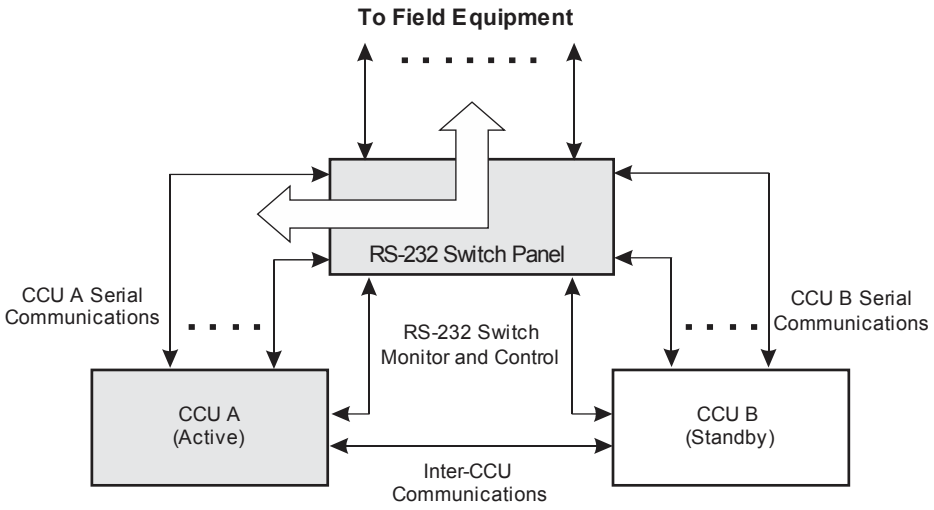
The quiescent current of the +12 V power supply input on the RS-232 Switch Panel is 15 mA. The maximum power requirement on the +12 V input during operation is 230 mA.

Through a toggle switch on the RS-232 Switch Panel, you designate one of the CCUs as the Active unit. If the Active unit hardware or software fails, the Active CCU is automatically switched offline, and the Standby unit is switched through to the field equipment (i.e., it is made Active).

The RS-232 Switch Panel is not equipped with EMI protection circuitry. If the connection length exceeds 3m, a Serial Surge Protection Panel (GE item number 540-0249) or equivalent protection device should be installed.

Figure 30 shows a redundant D20 system, with CCU A active.

Figure 30: Redundant D20 system with CCU A active



If the Active CCU fails:

- The Standby CCU detects the failure through the inter-CCU communications link.
- The Standby CCU commands the RS-232 Switch Panel to switch over all serial connections.
- The RS-232 Switch Panel switches all serial field connections to the Standby CCU, which now becomes the Active CCU.

If CCU A fails, CCU B becomes active. See Figure 31, “Redundant D20 system - If CCU A fails”.

Figure 31: Redundant D20 system - If CCU A fails

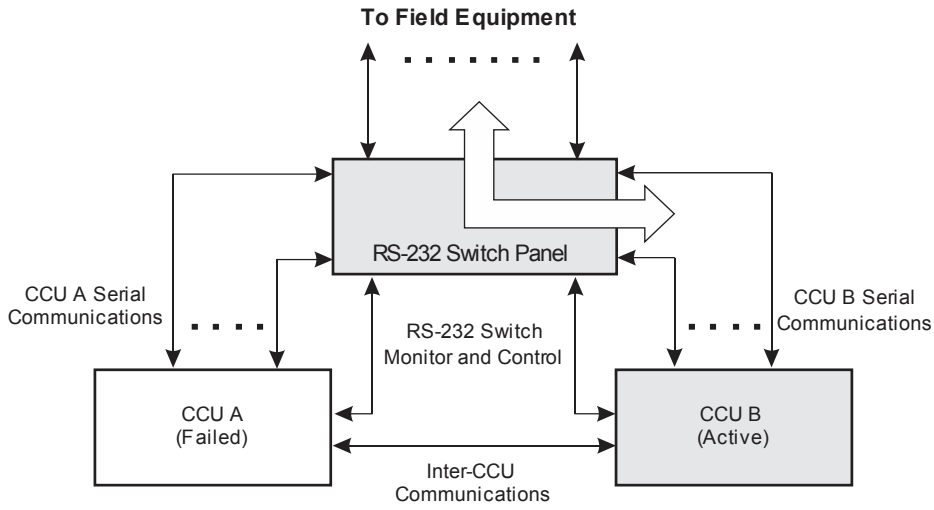
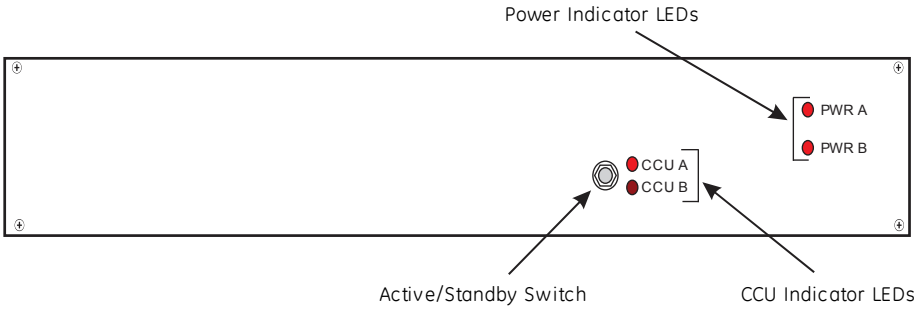


Figure 32: RS-232 Switch panel



A pair of LEDs marked *CCU A* and *CCU B* indicate which of the D20 units is currently active. If the hardware or software of the active unit fails, it is automatically switched offline and serial connections to the field are transferred to the standby unit. A toggle switch on the RS-232 switch panel can be used to switch the D20 devices between active and standby modes.

Failover sequence

If the active D20 unit fails, the following actions occur:

1. The standby D20 unit detects the failure through the lack of a heartbeat signal on the ping cable or through a status change on the watchdog cable.
2. The standby D20 unit attempts to pull the RS-232 switch panel to assume the active state.
3. The RS-232 switch panel transfers all serial field connections to the standby D20, which then becomes the active D20.

Required components

To implement a redundant D20 system, you need the components: listed in Table 20.

Table 20: Redundant D20 system - required components

Component	Function	Part Number
RS-232 Switch Panel	Communications switch.	517-0247
Power Supply	Power supply to power the RS-232 switch panel. Input: 85 – 264 V AC or 90 – 350 V DC.	580-0046
Watchdog Cable Assembly	Connects D20 A to the RS-232 switch panel.	977-0160
	Connects D20 B to the RS-232 switch panel.	977-0160
Ping Cable Assembly	Links both D20 units to facilitate a heartbeat message that determines the status of the active unit.	977-0122
RS-232 Serial Cable	Connects the D20 to the RS-232 switch panel which is then connected to external field devices.	977-0121
Power/SysFail Cable	Connects the RS-232 switch panel to D20 external power supply.	970-0161
Ground Cable	Provides a ground connection for the RS-232 switch panel.	970-0182

NOTE

Pins 4 on switch panel connectors J2 through J9 are tied together and to the panel's power supply. Any loading from field devices on these pins, loads the RS-232 panel power supply and should be taken into consideration when sizing power supplies.

To set up a redundant system

It is recommended that you install and configure one standalone D20 unit to ensure that your configuration is valid and that device communications are operating properly. Once this is done, proceed with the installation of the redundant system.

1. Mount the D20 devices in a rack and connect power and ground.
2. Mount the RS-232 switch panel.
3. Plug the connector of watchdog cable A (GE part number 977-0160) to serial connector COM 6 on the first D20 (CCU A).
4. Connect the bare leads of watchdog cable A to TB1 (position 1 and 6-8) on the RS-232 switch panel.
5. Plug the connector of watchdog cable B (GE part number 977-0160) to serial connector COM 6 on the second D20 (CCU B).
6. Connect the bare leads of watchdog cable B to TB1 (position 11 and 14-16) on the RS-232 switch panel.
7. Connect one end of the ping cable to the first D20 and the other end to the second D20. This ping cable must be connected to the same serial port number on both units.
8. Use standard RS-232 cables (GE part number 977-0121) to connect the D20 serial communication ports to the serial ports on the RS-232 switch panel. P1 through P8 are connected to the first D20, P9 through P16 are connected to the second D20. Connections from the switch panel to both D20 units should be made in the same order. For example, if P1 is connected to port 3 on the first D20, P9 should also be connected to port 3 on the second D20.

NOTE

At least one RS232 cable (GE part number 977-0121) from each D20MX MUST be connected to the switch panel to enable proper switch over operation. Failure to do so may result in the D20MX entering the "disabled" mode during a failover.

9. Connect field devices to J1 through J8 on the RS-232 switch panel.

RS-232 switch panel operation

The RS2-32 switch panel has two sets of indicator LEDs:

- PWR A/PWR B: When lit, power and communications are received from the connected units. Normally, both LEDs are lit.
- CCU A/CCU B: Normally, one LED is lit, indicating which unit is active.

The active/standby switch on the front of the RS-232 switch panel is used to:

- Restore a previously failed unit to active status once it has been repaired.
- Manually force a unit to active status so that routine maintenance can be performed on the other unit.

To manually operate the RS-232 switch panel

1. Pull the active/standby switch straight out to release it from the locked position.
2. Switch it up to make unit A active or down to make unit B active.

The CCU A/CCU B LED indicator indicates which unit has been activated.

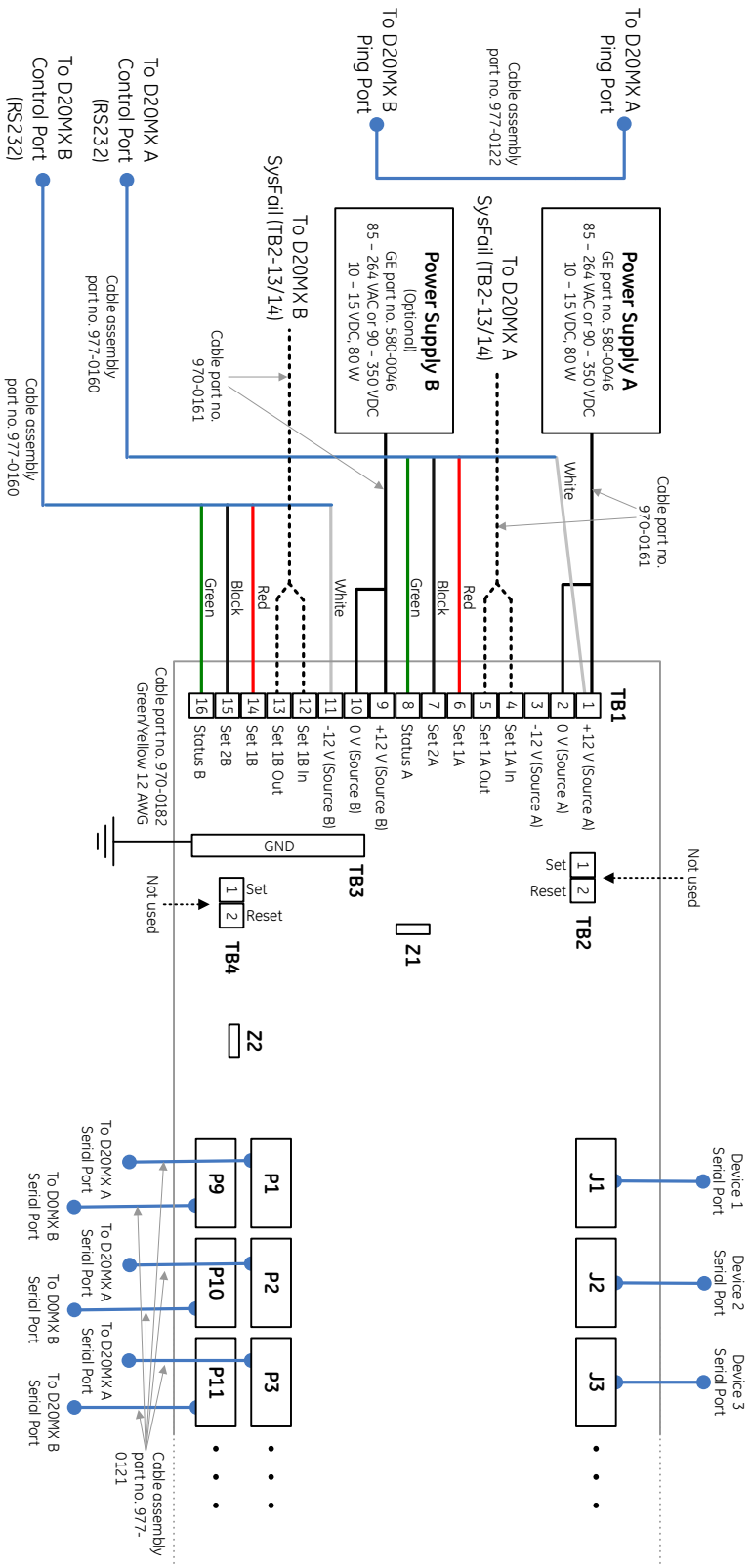
Redundancy wiring diagrams

Figure 33 illustrates how to wire the D20MX units and RS-232 switch panels to enable system redundancy:

NOTE

The D20MX watchdog (control) port, heartbeat (ping) port, and serial port assignments are software configurable. Refer to the *D2x Configuration Guides*.

Figure 33: Redundancy wiring - single RS-232 switch panel



D20MX Substation Controller

Chapter 5: Powering-up and Testing a D20 Substation Controller

Once you have made all field wiring and communication connections and have completed the necessary hardware configuration, the next step is to power-up the D20MX and verify that it is functioning properly.

Use this chapter to prepare for and correctly perform the power-up and other tests. This chapter includes:

- What is needed to test: WESMAINT II+ facility, SHELL and SGConfig
- How to power-up the D20MX and conduct the BOOT Test: Power On Self-Test
- How to carry out a redundant system test

Before any of the tests and procedures in this section can be performed, a valid configuration file must be loaded into the D20MX NVRAM.

If you have replaced the main board of the D20MX, then you need to restore the configuration file so that diagnostic tests can be performed.

If this power-up and test procedure reveals that your D20MX is not functioning properly due to software malfunction, then you need to download code and configuration files.

See the SGConfig online help.

Required for testing

The system components that are required for configuring and testing the D20MX are:

- WESMAINT II+ facility
- SHELL
- SGConfig application

NOTICE

To prevent burning out the main processor board, make two important checks before switching on the D20MX:

- Check that the external power supply input level is correct for the Power Supply fitted to the chassis. See section: “D20 power supply” on page 26.
- If you have 125 V DC or 110V AC input, then jumpers Z22 and Z23 on the WESTERM D20M+: 517 - 0225 or 517 - 0224 must be jumpered 2 - 3.

Accessing WESMAINT II+ using a terminal

You can use a VT100-compatible terminal or a terminal emulation program to directly access the WESMAINT II+ facility. SGConfig's Terminal Emulator is an example of a suitable terminal emulation program.

For further information about using WESMAINT II+ software to perform any of the test procedures in this section, refer to the *WESMAINT II+ User's Guide*.

Terminal Emulation

Microsoft Windows™ HyperTerminal can be used for terminal emulation but it is NOT recommended because code and configuration file download times are considerably increased.

The program Tera Term for Microsoft Windows™ does not have these limitations and is therefore recommended as a terminal emulation program. It can be downloaded from the Internet.

SHELL

The SHELL is a debugging and diagnostics tool that is accessible as a menu selection in WESMAINT II+, or from a basic login prompt if WESMAINT II+ is not available.

NOTICE

The approved method of using the diagnostic tools of the SHELL is through the front RS232 port.

Power up and test steps

To power up and test the D20MX:

1. "Set up a PC to act as a WESMAINTII+ terminal". See page 71.
2. "Power up the D20MX" on page 71. See page 71.

   Result: The D20MX automatically runs the Online Start-up test. See "Automatic on-line start-up test" on page 71.
3. "Test for redundancy". See page 72.
4. "Check that fail-over is functioning correctly". See page 73.
5. "Check that switch-over is functioning correctly". See page 73.
6. "Verify either hardware or software switch-over". See page 74.

Set up a PC to act as a WESMAINTII+ terminal

To set up a PC to act as a WESMAINT II+ terminal.

1. Open the VT100 compatible terminal emulation software you are going to use.
2. Verify (or set) terminal communications settings as follows:

Setting	Value
Data Rate	Baud rate of the D20MX (9600 or 19200 bps - See "RS-232" on page 63 to change)
Data Bits	8
Stop Bits	1
Parity	None
Flow Control	Xon/Xoff (software)
Connector Settings	COM1 or COM2, as required by the computer you are using

Result: The terminal emulator settings are now configured.

Power up the D20MX

To power up the D20MX

1. Check that all field wiring, grounding wires and fuses are in place and secure on your D20 system.
2. Turn the chassis-mounted Power Supply switch to ON.

   Result: The unit is powered-up.
3. On start-up, inspect the D20MX LED indicators on the front panel.

   Result: The RDY LED is flashing.

Automatic on-line start-up test

The D20MX automatically boots up when the power is switched on. Internal processes perform a series of routines. Self-diagnostic tests are performed followed by the spawning of all the software applications that reside in the unit's memory.

The self-diagnostic tests generate PASS or FAIL messages that can be viewed in your terminal emulator WESMAINT II+ screen. You can also see the results of the application spawning process.

Pass/Fail tests are carried out on the:

- User RAM
- NVRAM
- FLASH memory
- Root process

The self-diagnostics also return measures for:

- SDRAM size
- Bus Speeds
- CPU Core Speed

The NVRAM CRC test verifies that the configuration header is valid. If this fails, then the D20MX starts with a minimal set of applications that allow the system to be restored.

Code and configuration files

If the code and configuration files compiled for your specific system are already downloaded, then you can login straightaway to WESMAINT II+ for powering-up and testing.

If your system-specific code and configuration files are not downloaded, then you need to power-up with the default configuration. You can then login to the SHELL, download your system-specific files and restart the D20MX for testing.

For details, see the SGConfig online help.

Further testing

For further specific testing, log in to WESMAINT II+. See the WESMAINT II+ Users Guide and WESMAINT user guides for specific applications.

Test for redundancy

If you have a D20 redundant system, you must test that:

- CCU A and CCU B are communicating
- Fail-over is functioning correctly.

To check that CCU A and CCU B are communicating once you have powered-up the Primary and Secondary units:

1. On the front of the RS-232 Panel, check that CCU A LED is illuminated, which shows that CCU A is Active.

Both the PWR A and PWR B LEDs should be illuminated.

2. Connect a NULL modem cable (GE Energy part number 977-0529) to the RS-232 connector on the front panel of the active D20MX.
3. Attach the other end of the cable to the serial communications port of the PC or terminal.
4. Login to WESMAINT II+ through the emulator you are using.

   Result: The WESMAINT Main Menu appears.
5. Check to see that STNDBY appears at the top-left of this WESMAINT screen.

   Results: If this text shows, then the Primary and Secondary CCU are communicating.

   If this text does not show, then the Primary and Secondary are not communicating.

STNDBY appears on the Active CCU WESMAINT Main Menu display approximately one minute after power-up of the two units. Wait for this message to appear before following the next procedure.

Check that fail-over is functioning correctly

To check that fail-over is functioning correctly for the event of hardware failure:

1. On the front of the RS-232 Panel, check that CCU A LED is illuminated, which shows that CCU A is Active.

Both the PWR A and PWR B LEDs should be illuminated.

2. To simulate hardware failure, switch off the Active D20MX at the main power switch on the front of the unit.

   Result: If the RS-232 is functioning correctly, then it switches over to the Standby unit and the CCU B LED illuminates and the CCU A LED goes off.

Check that switch-over is functioning correctly

To check that switch-over is functioning correctly for the event of software failure:

1. On the front of the RS-232 Panel, check that CCU A LED is illuminated, which shows that CCU A is Active.

Both the PWR A and PWR B LEDs should be illuminated.

2. Connect a NULL modem cable (GE Energy part number 977-0529) to the RS-232 connector on the front panel of the D20MX designated as CCU A.
3. Attach the other end of the cable to the serial communications port of the PC or terminal.
4. Login to WESMAINT II+ on CCU A using your terminal emulator.

   Result: The WESMAINT Main Menu appears.
5. Select **Main Menu** > **System Functions** and press **ENTER**.

   Result: The WESMAINT Function Menu appears.
6. Select **SWITCH-OVER** on the **Function Menu** and press **ENTER**.

   Result: A password prompt appears.
7. Enter your password and press **ENTER**. The default password is *control*.

   Result: The CCU Switch-Over display appears.
8. Press **Ctrl-V** to begin switch-over.

   Result: A confirmation message appears: *Confirm Yes/No*.
9. Type **Yes** and press **ENTER**.

   Result: Fail over occurs

Verify either hardware or software switch-over

To verify either hardware or software switch-over.

1. Connect a NULL modem cable (GE Energy part number 977-0529) to the RS-232 connector on the front panel of the D20MX designated as CCU B, which was originally the Standby unit.
2. Attach the other end of the cable to the serial communications port of the PC or terminal.
3. Login to WESMAINT II+ through the emulator you are using.

   Result: The WESMAINT Main Menu appears.
4. If you can login to WESMAINT II+, this indicates that CCU B is the Active CCU.

   Results: Fail over has occurred.

If the previously Active A CCU powers-up after a fail-over from CCU A to CCU B, then STNDBY appears at top left when you login to WESMAINT II+ on CCU B. This can take up to a minute to occur.

If you cannot login to WESMAINT II+ on a CCU, then the unit is most likely powered down. Verify that the RDY LED is flashing and verify that the serial cable is connected correctly.

D20MX Substation Controller

Chapter 6: Configuring the Software

This chapter provides:

- An introduction to the software components used in the D20MX
- Customer service shell access
- D20MX User Accounts
- How to download image files to the Flash memory on your D20MX module on your system using a serial or network connection
- How to download a Hardware Support Package to the D20MX
- How to transfer D20 configurations to the D20MX
- How to update D20 configurations to use the D20MX firmware definition
- Software (feature) licensing
- How to configure serial expansion

Introduction to the D20MX software

The D20MX main processor board requires four valid files to be loaded:

- An operating system image file, called “vxWorks”, which resides in the file system on Flash memory
- An application image file, called “appl.out”, which resides in the file system on Flash memory
- A configuration file which resides in the NVRAM
- A Hardware Support Package (HSP) file, called “hsp.tar”, that resides in the file system on Flash memory.

Use this section to load the above files into your RTU system.

Image file terms

The following terms are used throughout this chapter of the manual when referring to the image files:

- Collectively the files vxWorks and appl.out are to be referred to as “image files”
- vxWorks refers to the “operating system image file”
- appl.out refers to the “application image file”

Hardware Support Package

The HSP is a collection of low level firmware files that provide boot loading support and low level hardware functionality defined by Field-Programmable Gate Array (FPGA) configuration information. The boot loading support consists of the JMON and Bootrom files. The HSP also includes an Emergency Recovery Image (ERI) that runs only during the HSP upgrade procedure to program the FPGAs.

There are two HSP files with the V1.5x release: one for each of the baud rates supported by the console port of the D20MX (i.e., 9600 and 19200 baud). The name of the HSP file indicates the baud rate of the console port and the version of the release. For example: hsp_v140_9600.tar is the v1.40 HSP release for a 9600 baud console port.

Customer service shell access

In certain cases, GE customer service may require access to a low-level shell called the "C" shell in the D20MX in order to troubleshoot a problem. The "C" shell is accessible from the D20M shell by typing **c**. To leave the shell, type **exit**.

The "C" shell can only be accessed from an RS232 port of the D20MX, and it must be enabled by a user whose "Monitor Access Level" is Read/Write (i.e., Administrator role). Once the "C" shell is enabled, only a user whose "Monitor Access Level" is Maintenance (i.e., Engineer role) or Read/Write is able to access the "C" shell.

"C" shell access is enabled by typing **eds** in the D20M shell. The eds command takes a parameter which defines how many seconds that a user is allowed to enter the "C" shell. Until the eds timer expires, a user with appropriate access is allowed to enter or re-enter the "C" shell as many times as required. After the eds timer expires, entry to the "C" shell is no longer allowed. If the parameter is not specified, the default timeout is 300 seconds (5 minutes).

A user log is generated each time a user runs the **eds** command or enters the "C" shell.

D20MX user accounts

The D20MX supports the following types of user accounts:

- Remote and local user accounts
- Factory default user account
- System default user account

Remote and local user accounts

The D20MX supports remote and local user accounts. Use remote user accounts whenever possible to increase the level of security and to decrease user administration effort. To implement remote user accounts, the D20MX uses Remote Authentication Dial-In User Service (RADIUS) with CHAP, EAP-TTLS and PEAP authentication methods. Refer to the *B014-1NCG WESMAINT II+ for the D20MX Configuration Guide* for details on how to configure the D20MX to use RADIUS.

When RADIUS is used, your RADIUS server provides a role ID to the D20MX. The role ID defines which commands and displays the user is allowed to access while logged in to the D20MX. To allow your RADIUS server to provide a role ID, configure your RADIUS server to use the GE vendor profile that is common to many Multilin products. Refer to the *B014-1NCG WESMAINT II+ for the D20MX Configuration Guide* for details on how to configure

your RADIUS server and the D20MX with the GE vendor profile. Also refer to Appendix A, *Default Role-Based Access Control Model* for the default role based access control model provided with the D20MX default configurations.

In the event all configured RADIUS servers are down or if RADIUS is not configured, the D20MX authenticates the user against the local configuration and password file. Local users are created with a default password of **changeme**. Use the **passwd** command from the D20MX SHELL prompt to change the default password to a strong password as soon as possible after downloading the configuration. Refer to the *B014-1NCG WESMAINT II+ for the D20MX Configuration Guide* for details on how to configure local user accounts and change the password of a user.

Factory default user account

The factory default configurations for the D20MX come with one default user account with:

- username: **admin**
- password: **changeme**

Replace this account or change the password for this account as soon as possible. Refer to the *B014-1NCG WESMAINT II+ for the D20MX Configuration Guide* for details on how to modify user accounts and how to change the password of a user.

System default user account

The D20MX configuration can be defaulted by pressing CTRL-F on a terminal connected over the front RS232 port during startup. In addition, if the D20MX detects a corrupt configuration on startup, it generates a system default configuration. The system default configuration comes with one user account:

- username: **recover**
- password: **system**

Login with this username and synchronize a configuration to the D20MX over the front RS232 port.

The D20MX can only be accessed over the front RS232 port with the system default configuration.

If you synchronize a configuration with any of the following errors:

- There are no usernames configured in the B014 User table,
- The B014 User table is disabled, or
- The B014 application definition does not match the firmware version,

then the applications do not start and you only have serial access in debug mode.

Login with the system default username over the front RS232 port and synchronize a correct configuration.

Download image files to the D20MX

When to download

Instances where you may need to download an operating system or application image file to your D20MX:

- When a new version of the operating system or application image has been released.
- If the D20MX has performed self-diagnostics and determined that the application image file is either missing or corrupted.

- After maintenance or replacement work that has deleted the application file.

Prerequisites for image download

The following items must be available before an application or operating system image file can be loaded into a D20MX over a serial or network link:

- Windows PC with SGConfig version 8.1 and higher software.
- The application firmware file, preferably located on a local hard drive. This file is to be named: appl.out.
- The operating system image file, preferably located on a local hard drive. This file is to be named: vxWorks.
- The D20MX module must be installed into a D20 chassis, ready to power-up.

Prerequisite for image download over a serial link

The following item must be available before an application and operating system image file can be loaded into a D20MX over a serial link:

- A NULL modem cable (GE Energy part number 977-0529) connecting the RS-232 connector on the front panel of the D20MX to the serial communications port of a PC or terminal.

Prerequisite for image download over a network link

The following items must be available before an application and operating system image file can be loaded into a D20MX over the network:

- An Ethernet switch and appropriate Ethernet patch cables to connect your PC's Network Adapter and the D20MX's Ethernet port 1 to the switch.
- The D20MX contains a configuration file with LAN enabled and an IP address that matches the one configured in SGConfig.
- The PC's Network Adapter is configured with an IP address on the same network as the IP address of the D20MX.

Download software over a serial connection

To download software to the D20MX:

1. Set up Tera Term on a PC. See section: "Set up Tera Term on a PC" on page 78.
2. Download application image file to the D20MX over a serial connection. See section: "Download image files to the D20MX over a serial link" on page 79.

   This comprises:

   - Application files
   - Operating system files

Set up Tera Term on a PC

To set up the Tera Term on a PC:

1. Connect a NULL modem cable (GE Energy part number 977-0529) from the RS-232 connector on the front panel of the D20MX to the serial communications port of the PC or terminal.
2. Start SGConfig.

   Result: The Welcome to SGConfig screen appears.
3. Open a project containing a D20MX device.

   Result: The project's Main Page appears.
4. Click on a D20MX device.

   Result: The ribbon changes to include the Communications group.

5. Click **Configure** ribbon group > **Communications** > **Connect** drop-down list > **Tera Term**.

   Result: Tera Term: New connection dialog appears

6. Click **Serial** and select the communications port on your PC from the **Port** drop-down list.
7. Click **OK**.

   Result: Tera Term: New connection dialog closes

   Result: The Tera Term VT window appears

8. Select **Setup** > **Serial port...**

   Result: Tera Term: Serial port setup dialog appears

9. Verify (or set) terminal communication settings as follows:

Setting	Value
Port:	COM1 or COM2, or as required by the computer you are using.
Baud Rate	baud rate of the D20MX (9600 or 19200 bps) See "RS-232" on page 63 if you need to change the baud rate.
Data	8 bit
Parity	none
Stop	1 bit
Flow Control	Xon/Xoff
Transmit delay	0 msec/char; 0 msec/line

10. Click **OK**.

    Result: The Tera Term settings are now configured.

Download image files to the D20MX over a serial link

Note: For a redundant system, download image files to the standby D20MX first. Then switch-over and download image files to the new standby D20MX.

To download application and operating system image files to a D20MX module:

1. Restart the D20MX.

   Result: The startup messages appear.

2. When the message "Press Ctrl-E to enter debug mode" appears, press **Ctrl-E** within 3 seconds.

   Result: The login dialog appears.

3. Log in:
   - For **User**: type a username that has Maintenance or Read/Write Access and press **Enter**,
   - For **Password**: type the password and press **Enter**.

   Result: The D20M> prompt appears.

4. Optional: Speed-up communications to shorten download time.

   Type **Baud 115200** and press **Enter**.

   Note: Select 57600 or 38400 if communications errors have occurred previously. Such errors can occur due to the presence of ambient EMI, a long cable length, a PC with communication limitations due to CPU speed or when using some serial to USB adapters.

   Result: The D20MX is now communicating at 115,200 baud.

   4.1. Select **Setup** > **Serial port...**

   Result: Tera Term: Serial port setup dialog appears.

   4.2. Select **115,200** from the **Baud Rate** drop-down list.

4.3. Click **OK**.

Result: Tera Term main window appears and is communicating at 115,200 baud.

5. Download the application image file:

5.1. Press **Enter** to verify that communication is active.

Result: The D20M> prompt appears if the connection is active.

5.2. Type **rz** and press **Enter** to put the D20MX into the state where it is ready to receive the downloadable code file

5.3. Click **File** > **Transfer** > **ZMODEM** > **Send** from menu bar

Result: A dialog box opens, prompting you to locate the appl.out file that you wish to download.

5.4. Select the correct file, and click Open to start the transfer


NOTE

Do not press any keys on keyboard and do not move the Tera Term window during download.

Result: The file transfer may take from less than 10 to over 30 minutes, depending on communication speed selected.
When complete, the D20M> prompt appears.

6. Download the operating system image file

6.1. Press **Enter** to verify that communication is active.

Result: The D20M> prompt returns if connection is active

6.2. Type **rz** and press **Enter** to put the D20MX into the state where it is ready to receive the downloadable code file.

6.3. Click **File** > **ZMODEM** > **Send** from menu bar.

Result: A dialog box appears, prompting you to locate the vxWorks file that you wish to download.

6.4. Select the correct file, and click **Open** to start the transfer


NOTE

Do not press any keys on keyboard and do not move the Tera Term window during download.

Result: The file transfer may take from less than 10 to over 30 minutes, depending on communication speed selected.
When complete, the D20M> prompt appears.

7. Type **al 0** to ensure the autologout timer does not interrupt the copy to flash.
8. Type **cf** to copy the image files to flash.

   Result: The copy may take a few minutes to complete. When complete, the D20M> prompt appears.
9. Type **el /r** to ensure that log is clear.
10. Type **boot** to restart device.

    Result: The image file load is completed.

    The flash memory of the D20MX now has the new application and operating system image file loaded.

Configuration File Download

You can use standard SGConfig procedures to download a configuration file over the serial port.

Download image files over a network connection

Procedure

To download application and operating system image files to the D20MX over a network connection:

NOTE

In the event that you have selected dialog checkbox "Do not show this message again", some of the following steps do not appear. Accordingly, ignore the affected steps.

1. Connect Ethernet port 1 of the D20MX to the Ethernet switch using the appropriate Ethernet patch cable.
2. Connect the PC's network adapter to the Ethernet switch using the appropriate Ethernet patch cable.
3. Start SGConfig.

   Result: The Welcome to SGConfig screen appears.
4. Open a project containing the target D20MX device.

   Result: The project's Main Page appears.
5. Click on the D20MX device.

   Result: The Communications group appears in the ribbon.
6. Click **Configure** ribbon group > **Communications** > **Options**.

   Result: D2x Device Communication Options dialog appears
7. Click **Interface** tab > Connection Type > **iSCS LAN** and select the Preferred LAN you wish to use, either **LAN A** or **LAN B**. This is most likely to be **LAN A**.
8. Click **OK**.

   Result: D2x Device Communication Options dialog closes.
9. Click **Edit** ribbon group > **Properties**.

   Result: The D20MX Device Wizard appears
10. Click **Next**.

    Result: The Project LAN properties appear.
11. Click **Next**.

    Result: The hardware and other properties appear for the device.
12. Click **Processor** tab > **Code Image** sub-tab.
13. Click the button with the ellipsis (**...**).

    Result: The Select Flash image file dialog appears.
14. Navigate to the folder containing the appl.out file and vxWorks file.
15. Select the **appl.out** file and click **Open**.

    Result: The full pathname of the appl.out file appears in the Flash Image File box.

    Note: To transfer the operating system image, simply ensure that a vxWorks file exists in the same folder as the selected appl.out file. SGConfig automatically transfers both files to the D20MX even though you only selected the appl.out file.
16. Click **Next**.
17. Click **Finish**.

    Result: The project's Main Page appears with the D20MX device selected.
18. Click the ribbon **Configure** group > **Configuration** > **Generate**.
19. Confirm that there are zero errors in the Device Log.
20. Click the ribbon **Communications** group > **Firmware transfer**.

    Result: Warning message appears and confirmation to continue is requested.
21. Acknowledge the warning and click **Yes** to continue or **No** to abort the operation.

Result: If Yes is selected, then refer to the following table. If No is selected, the operation is aborted.

Possible Result if Yes is Selected	When to expect this result	Go to step
Select Target IP Address dialog appears	If the D20MX is configured for device redundancy.	22
Login dialog appears	If the D20MX is not configured for device redundancy.	24

22. Choose one of the following options:
    - If the default standby IP address is not the correct one, click the **Standby IP address** checkbox and in the associated IP address field, enter the IP address of the standby unit.
      Tip: Click **Help** for information on how to determine the Standby IP address.
    - Click the **Active IP** address checkbox.
23. Click **OK**.

    Result: A login dialog appears.
24. Enter a **User Name** that has Maintenance or Read/Write access. Enter the associated **Password**.

    Result: The firmware transfer takes place. A dialog indicating the transfer and reboot is taking place is presented. The unit is rebooted once the transfer finishes. Once the reboot completes, the dialog disappears. The whole operation can take up to 8 minutes.

    The flash memory of the D20MX now has the new application and operating system image file loaded.
25. If the D20MX was configured for device redundancy, you may switch over the D20MX and repeat the above steps for the other unit.

Configuration file download

You can use standard SGConfig procedures to download a configuration file over the network.

Firmware integrity

The D20MX firmware uses a Firmware Integrity checking mechanism. This mechanism consists of a Primary and Secondary storage system, internal to the D20MX, for the firmware files and an MD5 checksum on the individual firmware files.

Two D20M Shell commands: **commit** and **revert** copy the firmware files from the Primary storage to the Secondary (commit), or from the Secondary to the Primary (revert).

The D20MX determines which set of files (Primary or Secondary storage) to use when starting up by:

1. Testing the integrity of the D20MX firmware files in the Primary storage.
2. If the integrity check of the Primary storage files is valid, the D20MX starts up with the Primary storage files.
3. If the integrity check of the Primary storage files fails, the D20MX tests the integrity of the firmware files in the Secondary.
4. If the integrity of the Secondary storage files is valid, the D20MX starts up with Secondary storage files.
5. If the integrity of the Secondary storage files fails, the D20MX defaults to the Boot ROM command prompt.

Committing new firmware

After new firmware has been downloaded (either via serial or network connection), and the D20MX has restarted and is operating correctly, the firmware must be "committed" to the secondary storage.

NOTICE

Once the new firmware is committed, you cannot revert to the old version of the firmware; see Section: "Reverting to old firmware" on page 83.

To commit new firmware:

1. Login as a user that has Maintenance or Read/Write access privileges.
2. Enter the D20M Shell.
3. Enter the **commit** command.

   Result: A prompt appears to confirm copying the firmware from Primary to Secondary.
4. Enter **yes** to confirm the copy operation. If anything else is entered, the command is canceled.

   Result: The firmware copy operation begins. Both 'vxworks' and 'appl.out' are copied.

   This operation takes approximately 3 minutes.

NOTICE

DO NOT shut off the power to the D20MX while the copy operation is in progress. If power to the D20MX is disrupted, during the copy operation, the firmware is likely to be corrupted.

NOTICE

If the D20MX is configured for device redundancy, perform this procedure on the standby unit. Then if desired, switch over and perform this on the other unit.

Reverting to old firmware

A previously committed version of the firmware (i.e., old firmware) may be recovered from secondary storage.

This feature is intended to be used if, after downloading a new version of the firmware, an issue is identified and you wish to recover the previous version of the firmware. A revert is only possible if the new firmware has not been committed; see Section: "Committing new firmware" on page 82.

To revert the firmware:

1. Login as a user that has Maintenance or Read/Write access privileges.
2. Enter the D20M Shell.
3. Enter the **revert** command

   Result: A prompt appears to confirm copying the firmware from Secondary to Primary.
4. Enter **yes** to confirm the copy operation. If anything else is entered, the command is canceled.

   Result: The firmware copy operation begins. Both 'vxworks' and 'appl.out' are copied.

   This operation takes approximately 3 minutes.

NOTICE

DO NOT shut off the power to the D20MX while the copy operation is in progress. If power to the D20MX is disrupted, during the copy operation, the firmware is likely to be corrupted.

5. Once the copy operation has completed, enter the **boot** command to restart the D20MX with the reverted firmware.

Download Hardware Support Package to the D20MX

When to download

Instances where you may need to download an HSP to your D20MX:

- When a new version of the D20MX firmware and HSP is released. In this case, make sure you upgrade the firmware first.
- After upgrading the firmware and HSP, you may decide to downgrade to the previous release. In this case, downgrade the HSP first.

Prerequisites for HSP download

The following items must be available before an HSP file can be loaded into a D20MX:

- Windows PC with SGConfig version 8.2 and higher software.
- D20MX Documentation CD (part number 588-0075 V1.5x) in either of the following formats:
  - Physical CD media, or
  - Zip file
- A NULL modem cable (GE part number 977-0529) connecting the RS-232 connector on the front panel of the D20MX to the serial communications port of the PC.

In addition, the following additional prerequisites must be met:

- You have local access to the D20MX because the last step of the procedure may involve power cycling the D20MX.
- You have taken precautions to ensure power will not be interrupted while you are running this procedure.
- You have allocated about 1 hour to perform the whole operation.

Prerequisites for HSP download over a network link

The following items must be available before an HSP file can be transferred into a D20MX over the network:

- An Ethernet switch and appropriate Ethernet patch cables to connect your PC's Network Adapter and the D20MX's Ethernet port 1 to the switch.
- The D20MX contains a configuration file with LAN enabled and an IP address that matches the one configured in SGConfig.
- The PC's Network Adapter is configured with an IP address on the same network as the IP address of the D20MX.

Download HSP over a serial connection

To download an HSP file to the D20MX over a serial connection:

1. Stage HSP file for SGConfig. See section: “Stage HSP File for SGConfig” on page 85
2. Set up Tera Term on a PC. See section: “Set up Tera Term on a PC” on page 78.
3. Stage HSP file for serial transfer. See section: “Stage HSP File for Serial Transfer” on page 86
4. Transfer HSP file to the D20MX over a serial connection. See section: “Transfer HSP file to the D20MX over a serial link” on page 87
5. Apply HSP. See section: “Apply HSP” on page 89.

6. If the D20MX is configured for device redundancy, you may switch over the D20MX and repeat the previous two steps for the other unit.

Download HSP over a network connection

To download an HSP file to the D20MX over a network connection:

1. Stage HSP file for SGConfig. See section "Stage HSP File for SGConfig" on page 85.
2. Transfer HSP file over a network connection. See section "Transfer HSP over a network connection" on page 88
3. Apply HSP. See section "Apply HSP" on page 89.
4. If the D20MX is configured for device redundancy, you may switch over the D20MX and repeat the previous 2 steps for the other unit.

Stage HSP File for SGConfig

1. Press the Windows Key and **E** at the same time

   Result: The Windows Explorer window appears.
2. Navigate to a folder to which you have write permissions.

   Result: The content of the folder is displayed.
3. Click the **New folder** button in Windows Explorer

   Result: A new folder is created with the name "New folder" and the cursor is positioned to allow renaming of the folder.
4. Rename the folder (e.g., **D20MX**). This folder is called the staging folder in the remaining steps of this procedure.

   Result: The folder is renamed.
5. Do either of the following:
   - Insert the D20MX Documentation CD into the computer's DVD/CD drive, or
   - Extract then CD zip file on to the root of your C: drive and double click the **readme.html** file under the **ISO-Image** sub-folder, which is nested two levels deep into the extracted folder.

     Result: The Documentation CD home page appears in your default Web Browser.

     Alternate result for "Insert the D20MX Documentation CD": The home page does not appear in your default Web Browser. In this case, navigate to the CD in Windows Explorer, and double-click the **readme.html** file on the root of the CD.
6. Click on the link named **D20MX Firmware Files**.

   Result: The Firmware Files folder is displayed. It contains folders named HSP, SAN0001.15X and SAN0002.15X.
7. Using Windows Explorer, navigate to the SAN0001.15X sub-folder under the Firmware Files folder and copy/paste the files as shown in the following table.

   To copy a file, select it and press **Ctrl-C**. To paste a file, click on the Windows Explorer window showing the staging folder created in step 4 and press **Ctrl-V**.

Navigate to folder on D20MX Documentation CD or Folder extracted from Zip File	Copy/Paste the following files to the staging folder created in step 4
Firmware Files\SAN0001.15X	appl.out VxWorks

   Result: The Windows Explorer window showing the staging folder is displaying the files shown in the above table.

8. If you are upgrading the HSP, decide which baud rate you want COM0 to operate at, and copy/paste one of the files as shown in the following table.

If the desired baud rate for COM0 is ...	Navigate to folder on D20MX Documentation CD or Folder extracted from Zip File	Copy/Paste the following file to the staging folder created in step 4
19200	Firmware Files\HSP	hsp_v15X_19200.tar
9600	Firmware Files\HSP	hsp_v15X_9600.tar

Result: The Windows Explorer window showing the staging folder is displaying one of the tar files shown above.

9. If you are downgrading the HSP, refer to the README.TXT file in the Firmware Files\HSP\Archive folder to determine which HSP version was used in the original firmware version. Then, copy/paste the corresponding file as shown in the following table.

Navigate to folder on D20MX Documentation CD or folder extracted from Zip file ...	Copy/Paste the following files to the staging folder created in step 4
Firmware Files\HSP\Archive	hsp_v1XX_19200.tar or hsp_V1XX_9600.tar

Result: The Windows Explorer window showing the staging folder is displaying one of the tar files shown above.

10. Start SGConfig,

    Result: The Welcome to SGConfig screen appears.

11. Open the project containing the configuration of the target D20MX device.

    Result: The project's Main Page appears.

12. Select the target D20MX device and click the ribbon **Configure** group > **Configuration** > **Hardware**.

    Result: The D20MX Device Wizard appears

13. Click **Processor** tab > **Code Image** sub-tab. Click the button with the ellipsis (...).

    Result: The Select Flash image file dialog appears.

14. Navigate to the staging folder created in step 4. Select the appl.out file and click **Open**.

    Result: The full pathname of the appl.out file appears in the Flash Image File box.

15. Click **OK**.

    Result: The project's Main Page appears with the D20MX device selected.

16. Generate the device configuration:

    16.1. Click the **Project** tab for the D20MX device configuration.

    16.2. Click the D20MX device.

    16.3. Click the ribbon **Configure** group > **Configuration** > **Generate**.

Stage HSP File for Serial Transfer

1. Press the Windows Key and **E** at the same time.

   Result: The Windows Explorer window appears.

2. Navigate to a folder to which you have write permissions.

   Result: The content of the folder is displayed.

3. Click the **New folder** button in Windows Explorer

   Result: A new folder is created with the name "New folder" and the cursor is positioned to allow renaming of the folder.

4. Rename the folder (e.g., **D20MXHSP**). This folder is called the staging folder in the remaining steps of this procedure.

NOTE

Do not use the code image folder that you would select from SGConfig to contain appl.out for a firmware transfer.

Result: The folder is renamed.

5. Do either of the following:
   - Insert the D20MX Documentation CD into the computer's DVD/CD drive, or
   - Extract the D20MX Documentation CD zip file on to the root of your C: drive and double click the **readme.html** file under the **ISO-Image** sub-folder, which is nested two levels deep into the extracted folder.

     Result: The Documentation CD home page appears in your default Web Browser.

     Alternate result for "Insert the D20MX Documentation CD": The home page does not appear in your default Web Browser. In this case, navigate to the CD in Windows Explorer, and double-click the **readme.html** file on the root of the CD.
6. Click on the link named **D20MX Firmware Files**.

   Result: The Firmware Files folder is displayed. It contains folders named HSP, SAN0001.15X and SAN0002.15X.
7. Using Windows Explorer, navigate to the SAN0001.15X sub-folder under the Firmware Files folder. If you are upgrading the HSP, decide which baud rate you want COM0 to operate at, and copy/paste one of the files as shown in the following table. To copy a file, select it and press **Ctrl-C**. To paste a file, click on the Windows Explorer window showing the staging folder created in step 4 and press **Ctrl-V**.

If the desired baud rate for COM0 is ...	Navigate to folder on D20MX Documentation CD or Folder extracted from Zip File	Copy/Paste the following file to the staging folder created in step 4
19200	Firmware Files\HSP	hsp_v140_19200.tar
9600	Firmware Files\HSP	hsp_v140_9600.tar

   Result: The Windows Explorer window showing the staging folder is displaying one of the tar files shown above.
8. If you are downgrading the HSP, refer to the README.TXT file in the Firmware Files\HSP\Archive folder to determine which HSP version was used in the original firmware version. Then, copy/paste the corresponding file as shown in the following table.

Navigate to folder on D20MX Documentation CD or folder extracted from Zip file ...	Copy/Paste the following files to the staging folder created in step 4
Firmware Files\HSP\Archive	hsp_v1XX_19200.tar or hsp_V1XX_9600.tar

9. Rename the file copied in one of the previous two steps to hsp.tar.

   Result: The Windows Explorer window showing the staging folder is displaying the hsp.tar file.

Transfer HSP file to the D20MX over a serial link

To transfer an HSP file to a D20MX module:

1. Restart the D20MX. (If this is a redundant system, restart only the standby D20MX).

   Result: The startup messages appear.
2. When the message "Press Ctrl-E to enter debug mode" appears, press **Ctrl-E** within 3 seconds.

   Result: The login dialog appears.

3. Log in:
   - For User: type a **username** that has Maintenance or Read/Write Access and press **Enter**.
   - For Password: type the **password** and press **Enter**.

   Result: The D20M> prompt appears.
4. Optional: Speed-up communications to shorten download time

   Type **Baud 115200** and press **Enter**.

   
   NOTE

   Select 57600 or 38400 if communications errors have occurred previously. Such errors can occur due to the presence of ambient EMI, a long cable length, a PC with communication limitations due to CPU speed or when using some serial to USB adapters.

   Result: The D20MX is now communicating at 115,200 baud.

   4.1. Select **Setup** > **Serial port...**

   Result: Tera Term: Serial port setup dialog appears.

   4.2. Select **115,200** from the **Baud Rate** drop-down list.

   4.3. Click **OK**.

   Result: TeraTerm main window appears and is communicating at 115,200 baud.
5. Transfer the HSP file:

   5.1. Press **Enter** to verify that communication is active.

   Result: The D20M> prompt appears if the connection is active.

   5.2. Type rz and press Enter to put the D20MX into the state where it is ready to receive the downloadable code file

   5.3. Click **File** > **Transfer** > **ZMODEM** > **Send** from menu bar.

   Result: A dialog box opens, prompting you to locate the hsp.tar file that you wish to download.

   5.4. Select the hsp.tar file from the folder created in step 4 of "Stage HSP File for Serial Transfer", and click Open to start the transfer.

   
   NOTE

   Do not press any keys on keyboard and do not move the TeraTerm window during download.

   Result: The file transfer may take from less than 10 to over 30 minutes, depending on communication speed selected. When complete, the D20M> prompt appears.
6. Optional: If you had changed the baud rate prior to the transfer, change the baud rate back to the original baud rate.

   If the original baud rate was 9600, type **Baud 9600** and press **Enter**.

   If the original baud rate was 19200, type **Baud 19200** and press **Enter**.

   Result: The D20MX is now communicating at 9600 or 19200 baud.

   6.1. Select **Setup** > **Serial port...**

   Result: TeraTerm: Serial port setup dialog appears.

   6.2. Select **9600** or **19200** from the Baud Rate drop-down list.

   6.3. Click **OK**.

   Result: TeraTerm main window appears and is communicating at 9600 or 19200 baud.
7. Close the TeraTerm window.

Transfer HSP over a network connection

To transfer an HSP file to the D20MX over a network connection:

1. Start SGConfig.

   Result: The Welcome to SGConfig screen appears.

2. Open the project containing the configuration of the target D20MX device.

   Result: The project's Main Page appears.

3. Click on the D20MX device.

   Result: The Communications group appears in the ribbon.

4. Change the communication options to enable LAN communication with the D20MX. Click the SGConfig ribbon Configure group > Communications > Options.

   Result: The D2x Device Communication Options dialog box opens.

5. Click the Interface tab the in the Connection Type group select iSCS LAN, then select the Preferred LAN you wish to use, either LAN A or LAN B. This will most likely be LAN A.

   Result: The iSCS LAN option is selected.

6. Click OK to close the D2x Device Communication Options dialog box

   Result: The dialog box is closed and the SGConfig ribbon **Configure** group > **Communications** > **Firmware** transfer pick list is now active.

7. Click the **Configure** group > **Communications** > **Firmware** transfer > **HSP transfer**.

   Result: A dialog displaying a warning appears.

8. Read the warning then click Yes to continue or No to abort the operation.

   Result: If Yes is selected, then refer to the following table. If No is selected, the operation is aborted.

Possible Result if Yes is Selected	When to expect this result	Go to step
Select Target IP Address dialog appears	If the D20MX is configured for device redundancy	step 10
Login dialog appears	If the D20MX is configured for standalone operation	step 12

9. Ensure the **Standby IP** checkbox is checked and if not, check it. In the associated **IP address** field, ensure the IP address of the standby unit **address** is displayed and if not, enter it.

   
   TIP

   Click **Help** for information on how to determine the Standby IP address.

10. Click **OK**.

    Result: A login dialog appears.

11. Enter the **User Name** and **Password** of an account having SHELL access level of Maintenance or higher and click **Login**.

    Result: The **Login** dialog box closes, and the **Transferring HSP** dialog box opens. The HSP transfer takes place. When the transfer is complete, the **Transferring HSP** dialog box closes, and the **HSP Transferred successfully** dialog box opens.

12. Click **OK** to close the HSP Transferred successfully dialog box.

    Result: The dialog box closes.

Apply HSP

1. Start SGConfig.

   Result: The Welcome to SGConfig screen appears.

2. Open the project containing the configuration of the target D20MX device.

   Result: The project's Main Page appears.

3. Change the communication options to enable serial communication with the D20MX.

   3.1. Click the SGConfig ribbon **Configure** group > **Communications** > **Options**.

   Result: The D2x Device Communication Options dialog box opens.

   3.2. Click the **Interface** tab; in the **Connection Type** group select **Direct Serial**. If necessary, select the **Communication Port**, and in the **Port Setting** tab, select the **Baud Rate** as follows:

Baud Rate	When to set this baud rate
The baud rate of the D20MX console port which is either 9600 or 19200 baud and can be changed with the JBAUD command.	If the D20MX is configured for device redundancy
The baud rate configured for COM0 in WESMAINT	If the D20MX is configured for standalone operation

   Result: The Direct Serial option is selected.

   3.3. Click **OK** to close D2x Device Communication Options dialog box

   Result: The dialog box closes.

4. Click the SGConfig ribbon **Configure** group > **Communications** > **Connect** to open the terminal emulator.

   Result: The Terminal Emulator tab appears.

5. If WESMAINT is running, press **Enter** to get the WESMAINT login screen.

   Result: The WESMAINT login screen appears

6. Enter a **User Name** and **Password** of a user account having SHELL access level of Maintenance or higher.

7. If WESMAINT is running, navigate to the D20MX SHELL using the WESMAINT menu items **2** followed by **3**. Wait for the countdown, then press **Enter** several times.

   Result: The **D20M>** prompt appears

8. Apply the HSP by clicking the SGConfig ribbon **Configure** group > **Actions** > **Apply HSP**.

   Result: A dialog box displaying a warning opens.

9. Read the warning then click **Yes** to close the warning dialog box.

   Result: The warning dialog box closes and the **Applying HSP** dialog box opens.

10. The terminal emulator screen shows the progress of the HSP update.

11. This process can take 5 minutes to 1/2 hour to apply the HSP depending on which components are updated.

12. When complete, there are two possibilities

    – An Information dialog box asks you to toggle the power switch on the D20MX. If so, perform the following steps:

    12.1. Click **OK** to close the information dialog box.

    Result: The dialog box closes.

    12.2. Toggle the power switch on the D20MX.

    Result: The D20MX restarts with the new JMON, Bootrom and FPGA.

    – An information dialog indicates the operation is complete. If so, just click **OK** to close the information dialog box.

13. Close the SGConfig Terminal Emulator.

Transfer D20/D200 configurations to the D20MX

Use this information to transfer existing D20 and D200 device configurations to the D20MX using either ConfigPro or SGConfig.

NOTICE

Transferring a multi-processor D200 only transfers the application configurations on the first processor.

This is manually resolved by moving applications from other processors to the first processor using the SGConfig device editing functions BEFORE converting the device to a D20MX in the instructions below.

NOTE

The word "transfer" is used within the context of this guide to mean that the device configuration files are moved and modified, in order to work properly on a D20 with a D20MX processor.

Transfer existing D20 or D200 configurations to the D20MX

Prerequisites

Before you can transfer a D20 or D200 device configuration, the following components must be present:

- SGConfig installed on the configuration computer. The minimum SGConfig version supported is 8.1.
- D20MX Documentation CD (part number 588-0075 VXX) in either of the following formats:
  - Physical CD media, or
  - Zip file
- D20 or D200 Configuration has been migrated to SGConfig with the Migration Wizard (Refer to the Migration Wizard screencast).

  Note: The Migration Wizard supports ConfigPro 2.0 and higher configurations.
- To save time, you may upgrade the firmware definition of your D20 or D200 Configuration to SAN0001 or SAN0002 in ConfigPro™ 5.03 or higher. If you choose this option and are updating a:
  - D20 device configuration, perform the steps in section:

    "Updating a D20 configuration to use the D20MX firmware definition with ConfigPro" on page 97.
  - D200 device configuration, perform the steps in the following sections:
    1. "Updating a D200 configuration to use the D20MX firmware definition with ConfigPro" on page 100.
    2. "Updating a D20 configuration to use the D20MX firmware definition with ConfigPro" on page 97.
- A NULL modem cable (GE part number 977-0529) connecting the RS-232 connector on the front panel of the D20MX to the serial communications port of the configuration computer.

Procedure

To transfer a D20 or D200 device configuration to the D20MX:

NOTE

In the event that you have selected dialog checkbox "Do not show this message again", some of the following steps do not appear. Accordingly, ignore the affected steps.

1. Start SGConfig.

   Result: The Welcome to SGConfig screen appears.

2. Choose the D20MX Factory Default Configuration file, D20MX01-XX.7zip or D20MX02-XX.7zip. based on the following criteria:
   - If transferring a configuration containing B009 versions greater than 310 and B021 versions greater than 912 use the file D20MX01-XX.7zip
   - If transferring a configuration containing B009 versions less than or equal to 310 and B021 versions less than or equal to 912, use the file D20MX02-XX.7zip.

3. If the D20MX01-XX or D20MX02-XX default configuration has already been imported, go to step 4 to open the default configuration. Otherwise perform these sub-steps:
   3.1. Click **GE** button > **Archive** > **Project** > **Restore**.

   Result: The Restore Project Details window appears.

   3.2. Click **...** .

   Result: The Select a File window appears.

   3.3. Navigate to the DVD/CD drive or the ISO Image sub-folder nested two levels into the folder extracted from the D20MX Documentation CD zip file. Then navigate to Configuration Files > SGConfig.

   Result: The two files D20MX01-XX.zip and D20MX02-XX.zip appear in the dialog.

   3.4. Select the appropriate file based on your decision in step 2.

   3.5. Click **OK**.

   Result: On completion a pop-up message appears (e.g., Project D20MX01-XX has been restored).

   3.6. Click **OK**.

4. Open the SGConfig project containing the D20 or D200 device.:
   4.1. Click the **GE** button.

   4.2. Click the required SGConfig project in the **Recent Projects** list or select the **Open Project** menu item.

5. Make a backup copy of the original D20 or D200 device configuration:
   5.1. Click the **Project** tab of the original D20 or D200 device configuration**.**

   5.2. Click the D20 or D200 device.

   5.3. Click the ribbon **Configure** group > **Edit** > **Copy**.

   5.4. Click a blank area on the page onto which the copy is to be placed.

   5.5. Click the ribbon **Configure** group > **Edit** > **Paste**.

   Result: The Copying device window appears.

   Result: Once completed a new device named COPY_OF_<original device name> or <original device name>_COPY appears.

6. Change the device type to D20MX.
   6.1. Click the **Project** tab of the original D20 or D200 device configuration.

   6.2. Click the D20 or D200 device.

   6.3. Click the ribbon **Configure** group > **Configuration** > **Hardware** > **Processor** > **Change Type**.

   Result: The Change Device dialog appears.

6.4. Select the **D20MX** type and click **OK**.

Result: A dialog is displayed indicating that the device type has been changed successfully.

6.5. Click **OK**.

Result: The device is now displayed as a D20MX.

7. Select a D20MX processor from the D20MX Device Wizard:
   7.1. Click the **Project** tab of the original D20 or D200 device configuration**.**
   7.2. Click the D20MX device.
   7.3. Click the ribbon **Configure** group > **Edit** > **Properties**.
   7.4. Click **Next** until the Processor tab appears.
   7.5. Click the **Processor** tab > **General** sub-tab.
   7.6. From the Part Number field, click **Select**.

   Result: The Select a Processor Card window appears.

   7.7. Select one of the three D20MX processor type part numbers (526-3001, 526-3003 or 526-3005).
   7.8. Click **OK**, **Next**, and **Finish**.

   Result: The D20MX Device Wizard closes.
8. Import the firmware definition from the factory default configuration (if you had opted to upgrade the firmware in ConfigPro, then this step is not necessary):
   8.1. Click the Project tab of the original D20 or D200 device configuration.
   8.2. Click anywhere on the main page of the project to deselect the device.
   8.3. Click the ribbon Configure group > Miscellaneous > Firmware Library.

   Result: The Firmware Library window appears with the firmware definition selected.

   8.4. Select **Import**.

   Result: The Firmware Import window appears.

   8.5. From the **Project Name** drop down list, select D20MX01-XX or D20MX02-XX based on the decision taken in step 2.

   Result: The SAN0001 or SAN0002 firmware appears in the Firmware Available list.

   8.6. Click **OK**.

   Result: The Firmware Library window reappears with the SAN0001 or SAN0002 firmware in the list.

   8.7. Click **Close**.

   Result: The Firmware Library window closes.
9. Apply the firmware definition from the factory default configuration (if you had opted to upgrade the firmware in ConfigPro, then this step is not necessary).
   9.1. Click the Project tab of the original D20 or D200 device configuration.
   9.2. Click the D20MX device.
   9.3. Click the ribbon **Configure** group > **Edit** > **Properties**.

   Result: The D20MX Device Wizard Basic Settings window appears.

   9.4. Click **Next** until the **Processor** tab appears.
   9.5. Click the **Firmware** sub tab and **Select**.
   9.6. Select either SAN0001/XX or SAN0002/XX as per the decision taken in step 2.

   Result: The Changing Device dialog appears. After some time it closes and the D20MX Device Wizard appears.

9.7. Click **Finish**.

Result: The D20MX Device Wizard closes.

10. Import the RADIUS roles from the D20MX default configuration into the D20MX device:

10.1. Double-click the D20MX device.

Result: The Application List popup appears.

10.2. Double-click the WESMAINT II+ application.

Result: The WESMAINT II+ table icon set appears.

10.3. Right-click the RADIUS Role Table icon and select **Import**.

Result: The Select source directory dialog appears.

10.4. Navigate to the DVD/CD drive or the **ISO Image** sub-folder nested two levels into the folder extracted from the D20MX Documentation CD zip file. Then navigate to **Configuration Files** > **DefaultTableSettings** > **B014-1 Wesmaint II+**.

Result: The file B014RADR.CSV appears in the dialog.

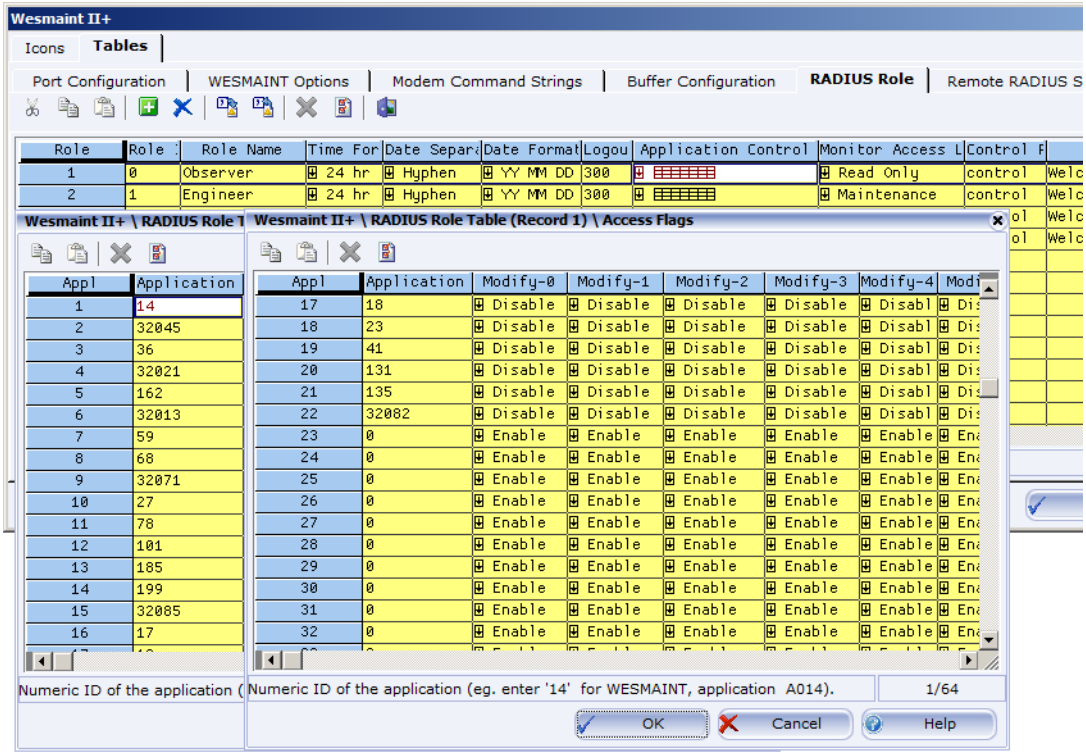
10.5. Select the file named **B014RADR.CSV**, and click **Open**.

Result: The WESMAINT II+ table icon set re-appears.

10.6. Double-click the RADIUS Role Table icon.

Result: The RADIUS Role Table editor appears.

10.7. Compare the first column of the Access Flags sub-table (RADIUS Role Table > Application Control) to the following figure to confirm that the import was successful:



10.8. Click **OK**, **OK** and **Close**.

Result: The WESMAINT II+ table editor closes.

11. If the D20 configuration being transferred is LAN-based, import the LAN Redundancy Manager point descriptors:

11.1. Click the **Project** tab of the original D20 or D200 device configuration.

11.2. Double-click the D20MX device.
Result: The Application List popup appears.

11.3. Double-click the System Point Database application.
Result: The System Point Database Properties dialog appears.

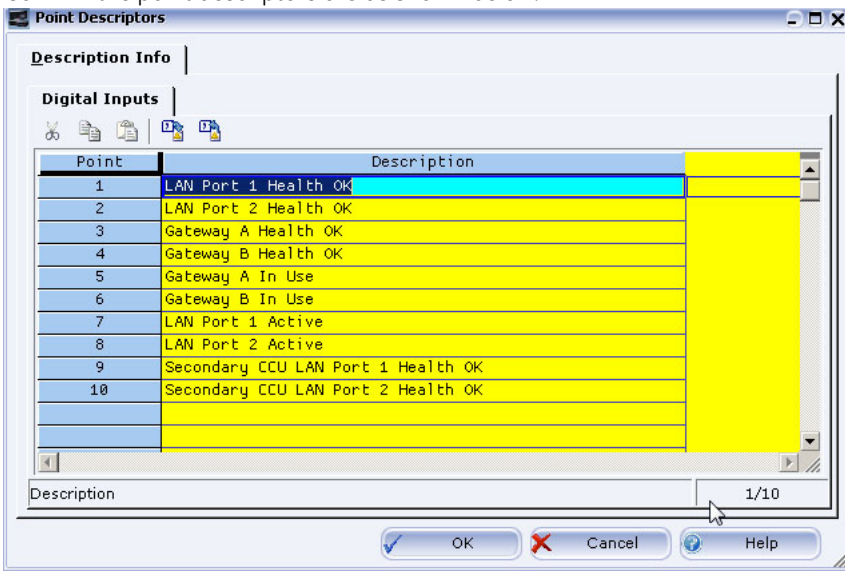
11.4. Select LAN Redundancy Manager and click **Descriptors**.
Result: The Point Descriptors dialog appears.

11.5. Click on the **Import** button. 
Result: The Import Point Descriptors dialog appears.

11.6. Click **OK**.
Result: The Browse For Folder dialog appears.

11.7. Navigate to the DVD/CD drive or the **ISO Image** sub-folder nested two levels into the folder extracted from the D20MX Documentation CD zip file. Then navigate to **Configuration Files** > **DefaultPointDescriptions** > **B119-1N LAN Redundancy Manager** and click **OK**.
Result: The Point Descriptors dialog appears.

11.8. Confirm the point descriptors are as shown below.



11.9. Click **OK**, **OK** and **Close.**
Result: The main project window appears.

12. Optionally, update the RADIUS and SYSLOG settings in B014-1N (WESMAINT II+):

12.1. Click the **Project** tab of the original D20 or D200 device configuration.

12.2. Double-click the D20MX device.
Result: The Application List popup appears.

12.3. Double-click the WESMAINT II+ application.
Result: The WESMAINT II+ table icon set appears.

12.4. Update the new tables: Remote RADIUS Servers Table, Remote Syslog Servers Table, TLS Auth Info Table, TLS CA Info Table, First PEM File Table, Second PEM File Table and Login Warning Banner Table, referring to the B014-1NCG WESMAINT II+ configuration guide.

13. If the configuration being transferred is LAN-based, generate the iSCS Configuration for the Project:

13.1. Click the **Project** tab of the original D20 or D200 device configuration.

13.2. Click: the D20MX device.

13.3. Click the ribbon **Configure** group > **iSCS** > **Generate**.

13.4. Confirm that there are zero errors in the Device Log; any Warnings are acceptable.

14. If the configuration being transferred is not LAN-based, generate the configuration for the device:

14.1. Click the **Project** tab of the original D20 or D200 device configuration.

14.2. Click the D20MX device.

14.3. Click the ribbon **Configure** group > **Configuration** > **Generate**.

14.4. Confirm that there are zero errors in the Device Log; any Warnings are acceptable.

15. Review warnings:

15.1. Click the **Project** tab of the original D20 or D200 device configuration.

15.2. Click the D20MX device.

15.3. Click the ribbon **Configure** group > **Draw** > select **Output Window**.

Result: The Device Log window appears.

15.4. Review all warnings and make corrections as needed, reviewing the backup copy to retrieve values that may have been replaced with default values during the transfer.

16. Transfer the new configuration to the D20MX:

16.1. Click the **Project** tab of the original D20 or D200 device configuration

16.2. Click: the D20MX device.

16.3. Click the ribbon **Configure** group > **Communications** > **Options**.

Result: The Device Communication Options widow appears.

16.4. Click **Interface** tab > **Connection Type**.

16.5. Select **Direct Serial** and change the **Communications Port** to the serial port that is connected to the D20MX.

Result: The Communications Options window shows that Connection Type is set to Direct Serial and the Communications Port is set to the serial port connected to the D20MX.

16.6. Click the **Port Settings** tab and set the **Baud Rate** to the baud rate of the D20MX (9600 or 19200 bps - see "RS-232" on page 63 if you need to change the baud rate), and select the **Software Transmit** and **Software Receive** checkboxes. Then click **OK**.

Result: The D2x Device Communications Options dialog closes.

16.7. Physically connect the PC's serial port using the RS232 NULL modem cable to either the front serial port of the:

- **Standby** D20MX, if the D20MX is configured for device redundancy, or
- **Standalone** D20MX, if the D20MX is configured for standalone operation.

16.8. Click the **Configure** ribbon group > **Communications** group > **Connect**.

Result: The Terminal Emulator window opens.

16.9. Login to the D20MX using the username **admin** and password **changeme**.

Result: The D20M> prompt appears.

16.10. Click the **Configure** ribbon group > **Actions**> **Sync To**.

Result: The Downloading Configuration File dialog appears showing the progress of the download. At the conclusion, a Confirm dialog appears with three buttons: Boot, Verify and Exit.

16.11. Click **Boot**.

Result: The D20MX reboots with the new configuration.

NOTE

All users that existed in the transferred D20/D200 configuration now have the default password: changeme. Change these passwords using the **passwd** command in the D20MX Shell. Refer to the WESMAINT II+ for D20MX Configuration Guide B014- 0NCG for details of this command.

NOTE

If the D20MX was configured for device redundancy, once the sync to operation is complete, the standby unit reboots and comes up again as standby with the new configuration. If desired, switch over and synchronize the new configuration to the other unit through the "Switch Over" and "Database Sync" functions available in the WESMAINT System Functions menu. Refer to the WESMAINT II+ for D20MX User's Guide B014-0NUG for details on these functions.

NOTE

When transferring a redundant D20/D200, ensure the new D20MX standby IP addresses do not conflict with other devices in the project or the secondary IP addresses described in the next note. If they do, you may disable the standby IP addresses or reassign them as described in "IP addresses" on page 60. If there are any conflicts, the WESMAINT error log of the D20MX will log warnings such as the following:

1 ROOT N0: W001: IP of RDT1 same as CCUB

Where RDT1 is the host name of the device with a conflicting IP address.

NOTE

When transferring a D200 configuration that contained network applications on node 2+:

1. Enter the node 2+ IP addresses of the original D200 configuration into the Hosts tab found in the LAN Properties under the D20 Device properties in SGConfig or the Project properties of ConfigPro.
2. Use the B119-1 LAN Redundancy Manager to create secondary IP addresses for the node 2+ IP addresses by referencing the host names created in the previous step. (See "B119-1NCG LAN Redundancy Manager for the D20MX" for further information).
3. In the network application (e.g., DNP3 Data Link) transferred from node 2+, change the Local Host Name field to contain the secondary host name. Refer to the configuration guides: "B052-0NCG DNP V3.00 Internet Data Link" or "B086-0CG IEC 60870-5-104 Data Link" for further details.
4. It is not necessary to enter the secondary host name for the MODBUS TCP/IP DPA A131-0.
5. If you are transferring the MODBUS TCP/IP DCA A135-0 from node 2+, then you need to ensure the IEDs accept the main IP address of the D20MX.

Updating a D20 configuration to use the D20MX firmware definition with ConfigPro

Use this information to update the firmware definition of an existing D20 device to the D20MX firmware definition. The result is a device archive that you can migrate into SGConfig for the purpose of transferring the D20 configuration to the D20MX.

Prerequisites

Before you can update the firmware definition of a D20 device configuration, the following components must be present:

- ConfigPro 5.03 or higher installed on the configuration computer.

  Note: If you are using a ConfigPro version older than 5.03, skip this procedure and migrate your ConfigPro project archives directly into SGConfig. Then follow the procedure in section: "Transfer D20/D200 configurations to the D20MX" on page 91.
- D20MX Documentation CD (part no. 588-0075 VXX) in either of the following formats:
  - Physical CD media, or
  - Zip file

Procedure

To update a D20 or D200 device configuration to the D20MX:

1. Press the Windows Key and **E** at the same time.

   Result: The Windows Explorer window appears.

2. Navigate to a folder to which you have write permissions.

   Result: The content of the folder appears.

3. Click the **New folder** button in Windows Explorer

   Result: A new folder is created with the name "New folder" and the cursor is positioned to allow renaming of the folder.

4. Rename the folder to **D20MXVXX**.

   Result: The folder is renamed to D20MXVXX.

5. Access the D20MX Documentation CD files by either:

   5.1. Insert the D20MX Documentation CD in to the computer's DVD/CD drive, or

   5.2. Extract the D20MX Documentation CD zip file on to the root of your C: drive and double click the **readme.html** file under the **ISO-Image** sub-folder, which is nested two levels deep into the extracted folder.

   Result: The Documentation CD home page appears in your default Web Browser.

   Result: Alternately for step 5.1, the home page does not appear in your default Web Browser. In this case, navigate to the CD in Windows Explorer, and double-click the **readme.html** file on the root of the CD.

6. Under the **D20MX Factory Default Configuration Files** section, click on the link named ConfigPro.

   Result: The Factory Default Configuration Files folder appears.

7. Using Windows Explorer, copy/paste the files as shown in the following table. To copy a file, select it and press **Ctrl-C**. To paste a file, click on the Windows Explorer window showing the new D20MXVXX folder and press **Ctrl-V**.

Navigate to folder on D20MX Documentation CD or Folder extracted from the Zip File	Copy/Paste the following files to the new folder D20MXVXX
MX01-XX.zip	MX01-XX.zip
MX02-XX.zip	MX02-XX.zip

   Result: The files shown in the above table appear in the new D20MXVXX folder of the Windows Explorer window.

8. Start Config Pro 5.03 or higher.

   Result: The main window of ConfigPro appears with the tree view of the project directory on the left.

9. Choose the D20MX Factory Default Configuration file, MX01-XX.zip or MX02-XX.zip. based on the following criteria:

   - If transferring a configuration containing B009 versions greater than 310 and B021 versions greater than 912 use the file MX01-XX.zip
   - If transferring a configuration containing B009 versions less than or equal to 310 and B021 versions less than or equal to 912, use the file MX02-XX.zip.

10. If the MX01-XX or MX02-XX default configuration has already been imported, go to step 18. Otherwise, select from the menu bar **Project** > **Archive Project** > **Restore**.

    Result: The Restore Project from ZIP File dialog appears

11. Under the Select Source Project ZIP File area, click the **document** icon.

    Result: The Select a Project ZIP file to Restore dialog appears.

12. Navigate to the new D20MXVXX folder.

    Result: The two files MX01-XX.zip and MX02-XX.zip appear in the dialog.

13. Select the appropriate file based on your decision made in the second step and click the **Select** button.

    Result: The Restore Project from ZIP File dialog appears with the selected file showing under the Select Source Project ZIP File area.

14. Under the "Restore To" area, click the **folder** icon.

    Result: The Select the Destination Project Directory dialog appears.

15. Navigate to your ConfigPro project folder on a hard drive of the configuration computer. The project folder is typically named *C:\WESDATA*.

    Result: The contents of the project folder are displayed, and the file named *WPL400.DB* is selected.

16. Click the **Select** button.

    Result: The Restore Project from ZIP File dialog reappears with the Project Directory set to the folder you selected in the previous step.

17. Change the Project Name if desired and click **OK**.

    Result: The main window of ConfigPro appears with the tree view of the project directory on the left. The new D20MX factory default project appears in the tree view.

18. Double-click on the D20MX factory default project.

    Result: The Main Page of the D20MX factory default project appears with the FAC_DEF device placed on the page.

19. Double-click the FAC_DEF device.

    Result: The Missing Applications! dialog appears.

20. Click the **Install** button.

    Result: The Select the Source Application Definition Directory dialog appears.

21. Navigate to the DVD/CD drive > **DEFNS** > **APPLDEF**.

    Result: The contents of the APPLDEF folder appears with the file *DAL100.DB* selected.

22. Click **Select**.

    Result: Messages are displayed about the application definitions being extracted to the configuration computer, and finally the Data Collection Applications of the FAC_DEF device appear.

23. Close the device configuration by clicking on the **door** icon.

    Result: The Main Page of the D20MX factory default project appears with the FAC_DEF device appearing on the page.

24. Click from the menu bar, **Device** > **Firmware**.

    Result: The Firmware Library dialog appears.

25. Depending on which factory default project you chose in step 9, select either **SAN0001/XX** or **SAN0002/XX**.

26. Click **Copy**.

    Result: The Firmware Information dialog appears.

27. In the "Copy To" area select the Project Directory and Project Name of the project you want to transfer to the D20MX.

    Result: The "Copy To" area contains the Project Directory and Project Name of the project you want to transfer to the D20MX.

28. Click **OK**, **Close** and the **door** icon

    Result: The main window of ConfigPro appears with the tree view of the project directory on the left.

29. Make a backup copy of your project.

    29.1. Select from the menu bar, **Project** > **Copy Project**.

    Result: The Copy Project dialog appears.

29.2. In the "From" area, navigate to the folder and select the project you want to transfer to the D20MX.

29.3. In the "To" area, enter a new unique name for the project.

29.4. Click **OK**.

Result: The main window of ConfigPro appears with the tree view of the project directory on the left.

30. On the tree view displayed to the left, navigate to the copied project and double-click on the project name.

    Result: The main window of the copied project appears.

31. Right-click on the D20 device you want to transfer and select **Properties**.

    Result: The D20 Device Properties window appears.

32. Click the **Processor** tab and the **Firmware** tab. Then click **Select**.

    Result: The Select a Firmware Type dialog appears. Depending on which factory default project you chose in the second step, either SAN0001 or SAN0002 appears.

33. Select whichever of SAN0001 or SAN0002 appears and click **OK** and **OK**.

    Result: A confirmation dialog appears asking if you want to make a backup copy now.

34. Click No because you have already made a backup.

    Result: Messages appear indicating the upgrade is in progress. Messages appear in the Device Log indicating the results of the upgrade. The D20 device appears with a red dot.

35. Review all warnings and make corrections as needed, reviewing the original copy to retrieve values that may have been replaced with default values during the upgrade

36. Right-click on the device and click **Generate**.

    Result: The device appears without a red dot.

37. Right-click on the device and click **Archive** > **Save**.

    Result: The Save Device to ZIP File dialog appears.

38. In the "Save To" area, click the **folder** icon.

    Result: A dialog appears with the title "Select a directory in which to save the project".

39. Navigate to a folder on your PC where you would like to save the device archive and click **Select** and **OK**.

40. Close ConfigPro.

41. Migrate the D20 Device Archive into SGConfig using the Migration Wizard (Refer to the Migration Wizard screencast).

Updating a D200 configuration to use the D20MX firmware definition with ConfigPro

Use this information to update the firmware definition of an existing D200 device to the D20MX firmware definition. The result is a device archive that you can migrate into SGConfig for the purpose of transferring the D200 configuration to the D20MX.

Prerequisites

Before you can update the firmware definition of a D200 device configuration, the following components must be present

- ConfigPro 5.03 or higher installed on the configuration computer.
- D20MX Documentation CD (part no. 588-0075 VXX) in either of the following formats:
  - Physical CD media, or
  - Zip file

Procedure

NOTICE

Migrating a multi-processor D200 only transfers the application configurations on the first processor.

This is manually resolved by moving applications from other processors to the first processor using the ConfigPro device editing functions BEFORE converting the device to a D20 in the instructions below.

Single and multi-processor D200 devices must first be changed into D20 devices before the D20MX firmware definition can be selected.

To change a D200 device into a D20 device perform the following steps:

1. Start ConfigPro 5.03 or higher.

   Result: The main window of ConfigPro appears with the tree view of the project directory on the left.
2. Make a backup copy of the project you want to transfer to the D20MX.
   2.1. Select from the menu, **Project** > **Copy Project**.

   Result: The Copy Project dialog appears.

   2.2. In the "From" area, navigate to the folder and select the project you want to transfer to the D20MX.

   2.3. In the "To" area, enter a new unique name for the project.

   2.4. Click **OK**.

   Result: The main window of ConfigPro appears with the tree view of the project directory on the left.
3. On the tree view displayed to the left, navigate to the project and double-click on the project name.

   Result: The main window of the copied project appears
4. Right-click on the D20 device you want to transfer and select **Tools** > **Change**.

   Result: The Change Device window appears.
5. Select type **D20** and click **OK**.
6. Follow the steps in section: "Updating a D20 configuration to use the D20MX firmware definition with ConfigPro" on page 97.

Software (feature) licensing

The D20MX application image file contains all the applications currently available for the D20MX. Some of these applications are licensed and are not available until they are unlocked.

These licensed applications are in groups, called application groups, and are identified by a license code.

Currently application groups 001 and 002 are available. Future releases of the application image file will provide more groups.

Use the D20M Shell command:

- **swlic-report** to view the list of application groups.
- **swlic-list** to view the applications in each group.

Enable trial period

An application group may be temporarily enabled for a 30-day trial period.

To enable a trial, use the command **swlic-trial -id 001** to enable application group 001.

For example:

```
D20M> swlic-trial -id 001
Trial license for '001' will be valid until 2013-03-18 (30 days)

Are you sure you want to enable the trial license for '001' [y/N] : y
INFO : Trial License  '001' enabled until 2013-03-18
```

The D20MX must be rebooted for the trial period to take effect

View the license status

The D20M Shell command **swlic-report** lists the status of the license. Each license group is listed.

For example:

```
D20M>swlic-report
License Report Utility v01.000

License Information
================================================================
Target Unit             : D20MX
Serial Number           : 526-3003-000001
Customer                : Utility ABC
License created from    : D400 Utilities V1.0.1
License Version         : 01.000

Application License                                      Status
================================================================
001 : D2X Classic Applications                  Trial Disabled
002 : Advanced Automation Applications          Trial Enabled
```

Unlock an application group

To unlock an application group, an unlock code must be purchased from GE. Please contact Customer Service for the unlock code.

Customer Service asks for the 'Hardware Identifier' of the D20MX that is to have the application group unlocked. This is a unique identifier for each D20MX and cannot be used with any other D20MX (that is, the license is non-transferrable).

View the hardware identifier

Use the D20M Shell command **swlic-info** to view the Hardware Identifier.

For example:

```
D20M>swlic-info
System Information
License Information Utility V01.000

================================================================

Target Unit                     : D20MX
Hardware Identifier             : 303064303163306237323461
License File                    : /tffs0/swLicense/license.key: Good
```

Customer Service sends you either:

- An unlock code
- An new license file (license.key)
- Or a batch file (batch.lic) which can be used on multiple D20MXs

Unlock code

If Customer Service send an unlock code, use the D20M Shell command **swlic-unlock -l <unlock code>** to unlock the application group.

For example:

```
D20M>swlic-unlock -l 6E623851703035375330616 26B66706643673D3D
Unlock Key is Valid
Info : License for '001' and been unlocked
```

This unlocks the application group 001.

License file

If Customer Service sends a license file (license.key), use a SCP (Secure Copy) application, such as WinSCP, to copy the license file over the network to the /ram directory on the D20MX.

Alternatively, use the D20M Shell **RZ** command to download the license file via Z-Modem through the console port. The RZ command automatically places the file in the /ram directory.


NOTE

The file must be named **license.key**.

Use the D20M Shell command **CL** (Copy License) to process the license file. This command copies the license file to the correct location on the D20MX, and if there are no errors, the D20MX automatically restarts.

For example:

```
D20M>cl
Found License file (/ram/license.key) - copying
copying file /ram/license.key -> /tffs0/swLicense/license.key
License file copied  -- rebooting ....
```

Batch file

If Customer Service sends a batch file (batch.lic), use a SCP (Secure Copy) application, such as WinSCP, to copy the batch file over the network to the /ram directory on the D20MX.

Alternatively, use the D20M Shell **RZ** command to download the license file via Z-Modem through the console port. The RZ command automatically places the file in the /ram directory.


NOTE

The file must be named **batch.lic**.

Use the D20M Shell command **CL** (Copy License) to process the batch file. This command processes the /ram/batch.lic file, extracting the appropriate license block and creates a new license file (license.lic). If there are no errors, the D20MX automatically restarts.


NOTE

For the batch file to be processed, a license file must be in place. Use the command **swlic-info** to verify a license file is in place.

For example:

```
D20M>cl
Found Batch file (/ram/batch.lic) - processing
copying file /ram/batch.lic -> /tffs0/swLicense/batch.lic
Batch License Installation '/tffs0/swLicense/batch.lic'
Searching for serial number '526-3003-000001''
License Found in Batch File
copying file /ram/newlicense.key -> /tffs0/swLicense/license.key
Success : Success  License file updated
```

Configuring Serial Expansion Cards

A D20MX can be ordered with up to four serial expansion auxiliary cards. Each card provides 7 serial ports. Configure serial expansion cards as follows in SGConfig and ConfigPro.

If using SGConfig to configure serial expansion cards:

1. Start SGConfig.

   Result: The Welcome to SGConfig screen appears.
2. Open the SGConfig project containing the D20MX device.
   - 2.1. Click the **GE** button.
   - 2.2. Click the required SGConfig project in the **Recent Projects** list or select the **Open Project** menu item.
3. Add Serial Expansion Auxiliary cards from the D20MX Device Wizard:
   - 3.1. Click the Project tab of the D20MX device configuration.
   - 3.2. Click the D20MX device.
   - 3.3. Click the ribbon **Configure** group > **Edit** > **Properties**.
   - 3.4. Click **Next** until the Processor tab appears.
   - 3.5. Click the **VME Cards** tab. The Serial Expansion card will be under **Available VME Expansion Cards**.
   - 3.6. Click **Select** once for each serial expansion card in the D20MX hardware configuration

     Result: 1 to 4 Serial Expansion Auxiliary Cards show up under **Selected VME Expansion Cards**
4. Click Next and Finish.

   Result: The D20MX Device Wizard closes.

If Using ConfigPro to configure serial expansion cards:

1. Start ConfigPro

   Result: The ConfigPro splash screen starts.
2. Open the ConfigPro project containing the D20MX device.
3. Double click the project appearing in the Projects tab.
4. Right click on the device and select **Properties**.

   Result: The D20 Device Properties dialog appears.
5. Click the **VME Cards** tab. The Serial Expansion card will be under the list named **Available VME Expansion Cards**. Even though these cards do not have the same part number as the D20MX Serial Expansion Auxiliary Card, they can be used to make the required serial ports available in ConfigPro.
6. Click **Select** two times for each Serial Expansion Auxiliary Card installed on your D20MX.

   Result: 2 to 8 VME Expansion Cards show up under **Selected VME Expansion Cards**.
7. Click **OK**.

   Result: The D20 Device Properties dialog closes.

After performing the above procedure in either SGConfig or ConfigPro, select the expansion serial ports using the naming convention shown in Table 21. Refer to the particular application configuration guide for which field selects the port name.

Table 21: Port names used with SGConfig and ConfigPro

SGConfig Port Range	ConfigPro Port Range	Physical Com Ports
COM1 to COM7	COM1 to COM7	Port 1 to 7 on D20MX
CB-1 to CB-7	COM8, COM9, COMA to COME	Port 1 to 7 on First Serial Expansion Card
CC-1 to CC-7	COMF to COML	Port 1 to 7 on Second Serial Expansion Card
CD-1 to CD-7	COMM to COMS	Port 1 to 7 on Third Serial Expansion Card
CE-1 to CE-7	COMT to COMZ	Port 1 to 7 on Fourth Serial Expansion Card

D20MX Substation Controller

Chapter 7: Using the D20MX Substation Controller

The D20 Substation Controller operation can be monitored and accessed through the:

- D20MX processor front panel LEDs
  - Operational status LEDs
  - LAN port status LEDs
  - Fiber optic status port LEDs
- Power supply
- I/O peripherals

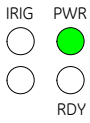
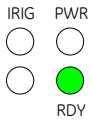
D20MX processor front panel LEDs

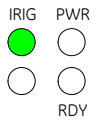
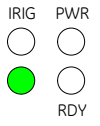
Once the D20MX is powered up, the LED indicators on the front panel become active. The indicators provide status information on the operation of the D20MX.

Operational status LEDs

The status LEDs (see Table 22) indicate the unit's operational status:

Table 22: D20MX - status LED operation

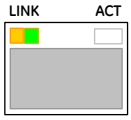
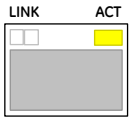
LED Display	Label	Color	Status Description
	**PWR**	Green	**Power** Solid light when 5 V DC power is correctly supplied to the processor board. OFF when 5 V DC is not present.
	**RDY**	Green	**Ready** Flashes when Initialization (boot-up and self-diagnostics) of the D20MX is complete and the unit is ready to process data.

LED Display	Label	Color	Status Description
	**IRIG**	Green	Flashes when an IRIG-B format time synchronization signal has been supplied to the unit and has been used to set the D20 system clock. **Note**: When removing IRIG-B signal, the LED keeps blinking for up to a minute before turning off.
		Green	Normally off; reserved for future expansion.

LAN port status LEDs

The LAN Port Status LEDs (see Table 23) provide a visual indication of the status for the Ethernet communication ports on the front of the D20MX.

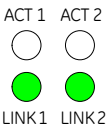
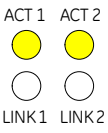
Table 23: D20MX - LAN port status LED operation

LED Display	Label	Color	Status Description
	**LINK**	Orange for 1000BASE-T. Green for 10/100BASE-T	**Link 1, Link 2** Solid light when an active device is connected to the Ethernet port.
	**ACT**	Yellow	**Activity 1, Activity 2** Flashes when data is transmitted or received on the channel.

Fiber optic port status LED

The fiber optic port status LEDs (see Table 24) provide a visual indication of the status for fiber optic ports 1 and 2.

Table 24: D20MX - Fiber optic port status LED operation

LED Display	Label	Color	Status Description
	**LINK 1** **LINK 2**	Green	**Link 1, Link 2** Solid light when an active device is connected to the fiber optic port.
	**ACT 1** **ACT 2**	Yellow	**Activity 1, Activity 2** Flashes when data is transmitted or received on the channel.

D20 power supply LEDs

On the chassis-mounted D20 power supplies, an LED indicator is available for each supply voltage. The indicators are illuminated green when that voltage is present.

I/O peripheral LEDs

The WESDAC/WESTERM Peripheral pairs have a common section made up of components on the WESDAC and WESTERM boards. There are seven LED indicators on this common section.

Table 25 lists and describes the I/O peripherals - common LEDs.

Table 25: I/O peripherals - common LEDs

LED Name	Designation	Normal RUN	Not Initialized
DS1	Power On	On	On
DS2	MPU Run	Flash 10/sec	See Next Table
DS3	Tx1	Flickers Constantly	Depends on Nature of Fault
DS4	Rx1	Flickers Constantly	Depends on Nature of Fault
DS5	Tx2	Configuration Dependent	Depends on Nature of Fault
DS6	Rx2	Configuration Dependent	Depends on Nature of Fault
DS7	Fault	Off	See Next Table

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Chapter 8: Servicing the D20MX Substation Controller

This chapter describes how to:

- Inspect the unit
- Remove the D20MX processor
- Change fuses

Performing periodic inspection

Periodic inspection is recommended to ensure that:

- The device has sustained no accidental physical damage
- Connectors and cables are intact and firmly attached

Performing maintenance

The D20 does not require scheduled maintenance.

However, small metallic particles (such as wire clippings) can fall through the ventilation holes on the top of the unit, possibly damaging or interfering with the safe and reliable operation of the D20.

NOTICE

Ensure that the D20 is protected from falling debris during maintenance. If you cover the unit for maintenance, remove cover before operating to provide adequate cooling airflow.

Removing the D20MX processor module

The D20MX can be removed from a D20 Substation Controller non-VME (GE part number 500-0305), a D20 Substation Controller VME (GE part number 500-0280) D20 chassis.

NOTICE

Ensure that you are sufficiently grounded to prevent ESD damage to the D20MX or other components. See section: "Grounding the D20MX" on page 52.

To remove the D20MX from a D20 chassis

1. Power down the D20 and disconnect the power supply.
2. Disconnect all communication cables from the front panel of the D20MX and the backplane of the D20 chassis.
3. Loosen the front panel retaining screws.
4. Remove the blank plates located above and below the D20MX.
5. Slide the D20MX partially out.
6. For the D20MX Non-VME with Dual 100Base-FX Fiber Optic Card (526-3005LF) only:
   - 6.1. Disconnect the 975-1236 cable (connecting the fiber optic daughter card) from connectors J3 and J4 on the D20MX processor module.
   - 6.2. Loosen the D20MX fiber card front panel retaining screws.
   - 6.3. Carefully slide out the D20MX fiber card partially.
   - 6.4. Remove the 975-1236 cable through the middle slot in the chassis.
   - 6.5. Store the D20MX fiber card in static-protective packaging.
7. Grasp the D20MX by the front handles and slide the processor module all the way out of the D20 chassis.

⚠CAUTION

Allow the D20MX to cool before removing. The heatsink of the D20MX may be extremely hot during and immediately after operation. Use caution when removing the processor module from the chassis to avoid being burned.

8. Store the D20MX in static-protective packaging.

Fuses

The fuses listed in section are standard fuses that are factory-installed, unless otherwise specified.

Fuse ratings may differ due to:

- Unique customer-specific configurations or requirements, or
- Product specification changes

When changing fuses, always check the original fuse for value and type, and ensure the replacement fuse you use is of that same value and type. Do not assume that installed fuse is of the correct value.

Replacing D20 fuses

Field-replaceable fuses for the standard D20 chassis-mounted Power Supplies are listed in Table 26.

Table 26: D20 field-replaceable fuses

Power Supply	Fuse	Fuse Function	Replacement Fuse	Fuse Part Number
580-2004	F1	+DC Input	LITTLEFUSE 0326012.MXP	940-0425: Fuse, SLO-BLO, 12A/250V
	F2	-DC Input	LITTLEFUSE 0326012.MXP	940-0425: Fuse, SLO-BLO, 12A/250V
580-2005	F1	+DC Input	LITTLEFUSE 0326012.MXP	940-0425: Fuse, SLO-BLO, 12A/250V
	F2	-DC Input	LITTLEFUSE 0326012.MXP	940-0425: Fuse, SLO-BLO, 12A/250V
580-2006	F1	Line/+DC Input	LITTLEFUSE 0313004.MXP	940-0424: Fuse, SLO-BLO, 4A/250V
	F2	Neutral/-DC Input	LITTLEFUSE 0313004.MXP	940-0424: Fuse, SLO-BLO, 4A/250V
580-2007	F1	Line/+DC Input	LITTLEFUSE 0313004.MXP	940-0424: Fuse, SLO-BLO, 4A/250V
	F2	Neutral/-DC Input	LITTLEFUSE 0313004.MXP	940-0424: Fuse, SLO-BLO, 4A/250V

D20MX Substation Controller

Chapter 9: Generating a System Default Configuration for the D20MX

In the event that it is necessary to generate a system default configuration for the D20MX (for example, the username, password or both are unavailable), this chapter provides the procedure.

Prerequisites

Prerequisites for generating a system default configuration for the D20MX:

- A Windows PC with SGConfig 8.1 or higher software.
- A NULL modem cable (GE Energy part number 977-0529) connecting the RS-232 connector on the front panel of the D20MX to the serial communications port of a PC or terminal.

Generate a system default configuration for the D20MX

To generate a system default configuration for the D20MX:

1. Set up Tera Term on a PC. See “Set up Tera Term on a PC” on page 78.
2. Restart the D20MX by turning the power off and on.

   Result: The startup messages appear.
3. When the message “Press Ctrl-F to reset to factory defaults” appears, enter **Ctrl-F** within 3 seconds.

   Result: The prompt: “Do you wish to reset to Factory Defaults (yes/no)?:” appears
4. Enter **yes**.

   Be sure to enter the whole word “yes”, not just “y”.

   Result: This causes the configuration to be defaulted and the password file to be deleted. The system reboots and eventually the “User:” prompt appears.

5. Login with the username **recover** and password **system**.
   Result: The D20M> prompt appears.
6. You may now synchronize a configuration to the D20MX using SGConfig.

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Chapter 10: Removing Configuration Data and Sensitive Information from the D20MX

In the event that it is necessary to remove the configuration data and sensitive information from the D20MX (for example, disposal purposes), this chapter provides the procedure.

It may also be necessary to remove data from a PC that has run ConfigPro or SGConfig for the purpose of configuring a D20MX processor. Again, this chapter provides the data removal procedure.

Remove configuration data and sensitive information from the D20MX

Prerequisites

Prerequisites for removing configuration data and sensitive information from the D20MX:

- A Windows PC with SGConfig 8.1 or higher software.
- A NULL modem cable (GE Energy part number 977-0529) connecting the RS-232 connector on the front panel of the D20MX to the serial communications port of a PC or terminal.

Removal Procedure

To remove configuration data and sensitive information from the flash file system and NVRAM of the D20MX:

If you wish only to return the D20MX to a system default state and do not need to securely wipe previous configuration information from the flash file system, refer to Chapter 9, *Generating a System Default Configuration for the D20MX*.

1. Set up Tera Term on a PC. See "Set up Tera Term on a PC" on page 78.
2. Restart the D20MX by turning the power off and on.

   Result: The startup messages appear.
3. Wait for the following messages to appear and press **Ctrl-E**:

   ```
   Application version: v1.50-
   Firmware: SAN0001.150/SAN0002.150
   ```

```
Press Ctrl-F to reset to factory defaults.
 3 2 1

UNAUTHORIZED ACCESS TO THIS DEVICE IS PROHIBITED
You must have explicit permission to access or configure this device.
All activities may be logged. Violations of policy governing this device
may result in disciplinary action and may be reported to law enforcement.
There is no right to privacy in accessing this device.

Press Ctrl-E to enter debug mode
1 2 3
```

Result: You are prompted to login.

4. Login as a user with maintenance access or higher (e.g., Engineer role).

   Result: You are logged in and the D20M Shell is started.

   Result: You are prompted to continue.

   ```
   Please Wait... 1
   Press Enter to Continue...
   ```

5. Press **Enter**.

   Result: The D20M Shell prompt appears.

6. Type the command SFD (Secure Factory Default) and press **Enter**.

   ```
   D20M> SFD
   ```

   Result: The SFD command runs.

   Result: You are prompted to continue.

   ```
   This command permanently deletes the configuration.
   Are you sure you wish to continue?[y]
   ```

7. If you wish to continue, type **y** and press **Enter**.

   Result: The SFD command will continue.

   Result: The SFD command:

   (A) Shuts down certain tasks,

   (B) Clears NVRAM,

   (C) Sets up JMON commands to resume the SFD command in case there is a power failure during the procedure,

   (D) Erases the '/user' volume (customer files),

   (E) Removes the JMON command,

   (F) Reformats the '/user' volume,

   (G) Checks the'/tffs0' volume, and reboots.

```
A) Shutting down tasks...
WARNING: Could not shut down 'B003'
WARNING: Could not shut down 'ROOT'
 Done
B) Clearing NVRAM... Done
deleting file /user/pkey_db/default_rsa
deleting file /user/pkey_db/default_dsa
deleting directory /user/pkey_db
C) Setting Power-fail JMON commands...
    Set 'AUTOBOOT_WARM_CMD_00' = 'fle 1 512 896'
    Set 'AUTOBOOT_WARM_CMD_01' = 'setenv AUTOBOOT_COLD_CMD_00 efn'
    Set 'AUTOBOOT_WARM_CMD_02' = 'saveenv'
    Set 'AUTOBOOT_WARM_CMD_03' = 'boot'
    Set 'AUTOBOOT_WARM_CMD_04' = ''
    Set 'AUTOBOOT_COLD_CMD_00' = 'warmboot'
 .. Done
```

```
D) Erasing '/user' Volume...
Erasing 384 blocks.
  1)      0K     256K     512K     768K
  5)   1024K    1280K    1536K    1792K
. . . .
377)  96256K   96512K   96768K   97024K
381)  97280K   97536K   97792K   98048K
Erase Complete.
Erase time:06:04.617s
 .. Done
E) Removing Power-fail JMON commands...
    Set 'AUTOBOOT_COLD_CMD_00' = 'efn'
    Set 'AUTOBOOT_WARM_CMD_00' = ''
    Set 'AUTOBOOT_WARM_CMD_01' = ''
    Set 'AUTOBOOT_WARM_CMD_02' = ''
    Set 'AUTOBOOT_WARM_CMD_03' = ''
 .. Done
F) Reformatting '/user'...
* Steps 1 of 3) TFFS Formatting (*This takes approximately 7
minutes)...
* Steps 2 of 3) Mounting '/user'...
. . . .
* Steps 3 of 3) HRFS Formatting ...
. . . .
No errors detected.
Volume OK.
 .. Done
G) Volume '/tffs0' already formatted as DOS: No change required
*** Phase 1) Set Customer File location: '/user'
*** Phase 2) Rebooting...
```

Result: The sensitive customer files have been completely erased from the file system. And the NVRAM has been cleared. A default configuration has been generated and installed.

Result: The D20MX reboots. Since the configuration has been defaulted, the D20MX is in debug mode.

Removing configuration data on a PC

If ConfigPro or SGConfig have been used to configure the D20MX processor, configuration data resides on the data storage media (e.g., hard drives, memory cards, etc.) of the PC running ConfigPro or SGConfig.

The D20MX configuration data can be removed from the PC by either:

- Recommended: Physically removing and destroying the data storage media, or
- Using a program to securely wipe (that is, completely erase) the data storage media (that is, not just reformat or remove the names of the files from the file allocation table).

D20MX Substation Controller

Chapter 11: Troubleshooting

This chapter describes how to troubleshoot:

- Serial communications
- Firmware version mismatches
- D20MX Shell commands
- D20MX Logs

Troubleshooting serial communications

This section describes how to troubleshoot serial communications using SA COM.

A serial analyzer captures and displays serial communications in hexadecimal format to assist in troubleshooting communications between an IED or SCADA master and the D20. GE Digital Energy has incorporated this powerful feature into the firmware of the D20MX via the SA COM (Serial Analyze Communications) command, allowing for the capture of serial communications from any of the serial ports.

Serial analyzer

A serial analyzer displays every character (including framing and parity errors) of the raw communication between an RTU and IEDs in the field or a SCADA master station. Test sets do not always display all of the data, as they normally parse the data and if there is a problem, that message is ignored.

Normally a serial analyzer is used to verify communications between two or more devices to see if a correct response is sent for a particular request. The captured messages can then be parsed and examined for their integrity. Any problems with the request or response can then be analyzed. In the case of when a device fails or does not respond, the serial analyzer may have captured the message that triggered the problem. It will also show the quality of the communications link by displaying any noise, framing errors (FR), parity errors (PA) or echoes in the message.

Prerequisites

The following items are required:

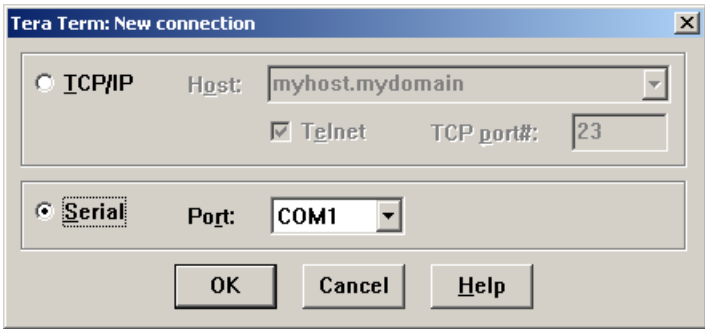
- A NULL modem cable (GE part number 977-0529) connecting the RS-232 connector on the front panel of the D20MX to the serial communications port of the PC.
- Windows* PC running a terminal emulator (e.g., TeraTerm Pro) that has a log-to-file feature.

Procedure

The procedure below assumes that TeraTerm Pro is being used as the terminal emulator. The steps may differ slightly if a different terminal emulator program is used.

To capture a serial analysis file:

1. Connect the computer's serial communications port to the WESMAINT port of the D20 using the WESMAINT cable.
2. Select Serial and the appropriate COM port for the computer, and then click OK.



3. Press Enter and a log in screen is shown. Type in your user name and password and press Enter.
4. The Main Menu is shown. Use the down arrow key to select option 2. System Functions and then press Enter (or press the number 2 key on the keyboard).
5. The System Functions menu is shown. Use the down arrow to select option 3. SHELL and then press Enter (or press the number 3 key on the keyboard).
6. Before starting to capture a serial analysis file, it is recommended to increase the WESMAINT baud rate so that the display buffer does not overflow. A display buffer overflow will occur when the data is coming in faster than WESMAINT can display it.

   A communications port running at a higher baud rate than the WESMAINT port usually causes this. Examples of buffer overflow are shown at the end of this document.

   To change the baud rate, type baud xxxxx (where xxxxx is the desired baud rate for your device) at the system prompt and press Enter. Type baud by itself and the available baud rates are displayed.

   The recommended baud rate is 115200.
7. Change the baud rate in the terminal emulator to match the baud rate selected in the previous step. If using TeraTerm, click Setup > Serial port and then change the baud rate and change the flow control to none. Click OK and press Enter to get the system prompt to appear.
8. Before starting to log data, a log file must be created.

   If using TeraTerm:

   8.1. Click **File** menu > **Log**.

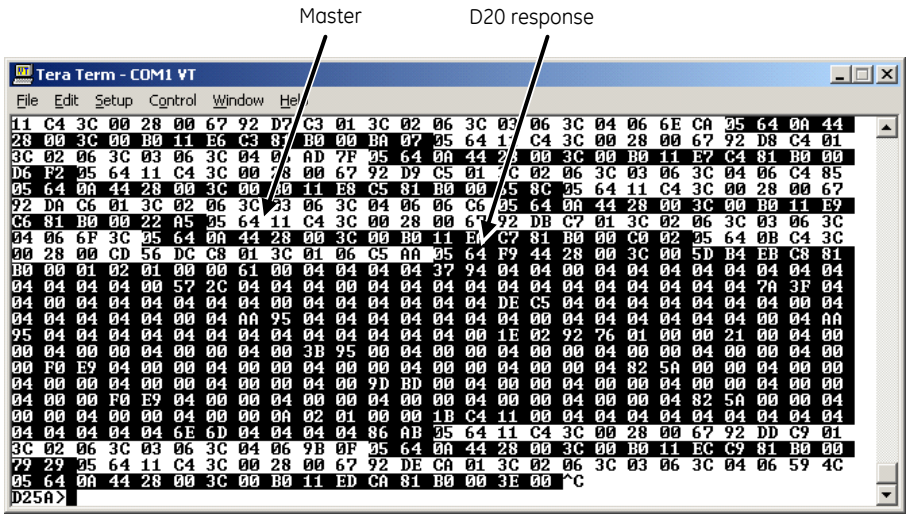
   8.2. Type in or select a file to log to.

8.3. Select a folder to store it in so it can easily be located later.

8.4. Click **Open** when finished.

9. Type **sa comx** (where comx is the communications port name you want to monitor) and then press **Enter**. The naming convention is described in "Port names used with SGConfig and ConfigPro" on page 105.

   Result: The D20 messages always appear in inverse text (white text on a black background) and the master request or the slave response always appears in regular text (black text on a white background).



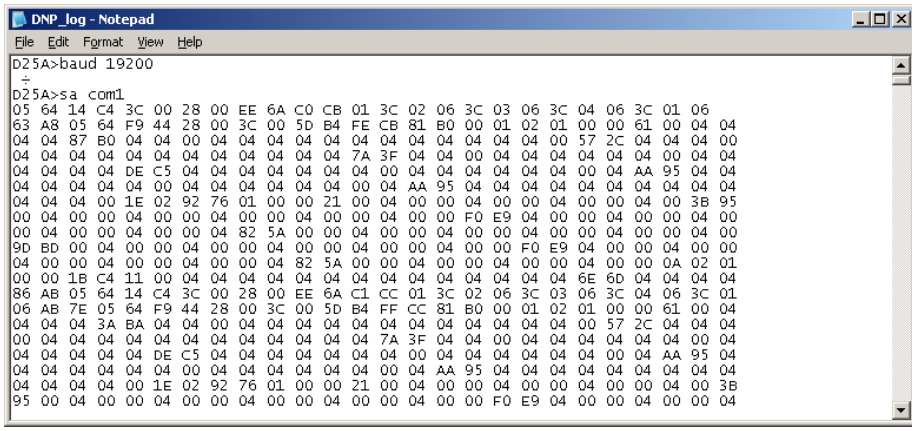
   In this example the D20 is acting as the slave and information is being sent out from the D20 in inverse text. To stop the capture when the appropriate data has been captured, press CTRL-C to return to the system prompt.

10. When the data capture is finished, close the log file in TeraTerm by clicking **Close**.

11. The log file can now be found in the folder it was stored in and can be opened using a text editor. The file can be parsed by copying this information into a computer-based automated parser or done manually by using a protocol description document.

NOTE

If using Notepad to view the contents of the log file, all of the communications traffic is shown in non-formatted text.



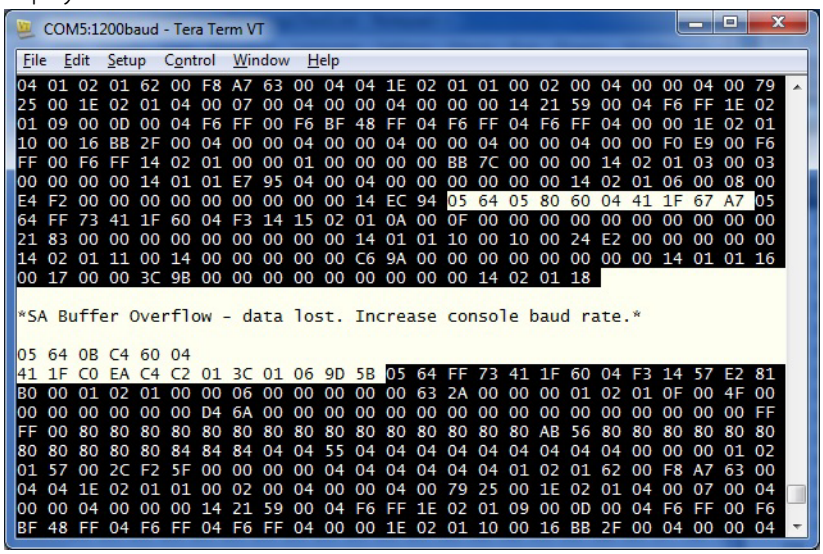
Advanced Analyzer Options

The SA command has several options for advanced communication analysis.

- Sync on receive (/SR): When a transition from sending bytes to receiving occurs, the received bytes start on a new line.
- Sync on Transmit (/ST): When a transition from receiving bytes to sending bytes occurs, the sent bytes start on a new line.
- Driver Events (/D): Display serial I/O driver events such as the RTS, CTS or DCD signal line transitions. Discarded bytes due to DCD squelching. See the D20MX Shell Users guide for a complete listing of driver events.
- Display the bytes in ASCII (/A): The data is displayed as ASCII characters instead of hexadecimal values.
- Display Width (/Wnn): Set the width of the display, where nn is from 5 to 50 (default is 25). Will have to adjust the width of the TeraTerm window.

Buffer Overflow

The below screen shows good serial communications data at the top of the screen and transitions to show buffer overflows at the bottom of the screen. When the buffer overflows the message 'SA Buffer Overflow - data lost. Increase console baud rate.' is displayed.



Troubleshooting firmware version mismatches

The D20MX checks the application version in the firmware against the Firmware Type (Application Definition) version every time it boots. If a discrepancy is detected a message is logged in the kernel error log. If the application with a version discrepancy is disabled, only a WARNING message is logged. If the application is enabled, then a FATAL message is logged and the D20MX enters disabled mode. All applications in the configuration are checked; the check does not stop at the first FATAL application.

The message includes the:

- Application number (e.g., A009N),
- Firmware/Application Definition version (e.g., CFG:811) and
- Application version (e.g., FW:812).

If the application version (FW) shows '<ukn>', then the firmware in the D20MX does not contain that application, yet there is a configuration for it.

Use the D20M Shell command EL to view these messages.

Example warning messages:

```
D20MX> EL
05/28/2015 11:19:01>WARNING: ApplDef ver mismatch:'A009N' (CFG:811, FW:812)
05/28/2015 11:19:01>WARNING: ApplDef ver mismatch:'A064' (CFG:110, FW:<ukn>)
05/28/2015 11:19:01>WARNING: ApplDef ver mismatch:'A199-0N' (CFG:111, FW:112)
05/28/2015 11:19:01>* FATAL: ApplDef ver mismatch:'B152-1N' (CFG:300, FW:<ukn>)
```

In this example the D20MX entered disabled mode because there a FATAL mismatch occurred with 'B152-1N'.

To resolve any FATAL or WARNING issues, either update the configuration to match the firmware or update the firmware to match the configuration.

To update the:

- Configuration, refer to the procedure “To transfer a D20 or D200 device configuration to the D20MX:” on page 92.
- Firmware, refer to the procedure “Download image files to the D20MX” on page 77.

D20MX Shell commands

This section outlines some of the D20MX Shell commands that can be used when working with the D20MX processor. Instructions in this chapter are excerpts from the D20MX Shell User's Guide.

Refer to the D20MX Shell User's Guide (SWM0074) for information about other commands not listed here.

Changing the baud rate

The D20MX Shell has the ability to change the communication speed of the WESMAINT port. This is useful when downloading large files.

Example: A 1 MB code file may take upwards of 40 minutes to download at 9600 bps (the default). At 38400 bps, the transfer is only 10 - 15 minutes.


NOTE

Most PCs cannot exceed 115,200 bps, and some terminal programs (Windows Terminal for example) may have other restrictions. Check the program's User's Guide for help.

SET BAUD RATE command

The SET BAUD RATE command changes the data rate of the WESMAINT port to a user-supplied value.

Command Format	BAUD baud_rate
Variables	None
Parameters	baud_rate = the new data rate for the port, in bps.
Example	Type BAUD 4800 and press ENTER.
Result:	The monitor switches to communicate at 4800 bps.
Special Considerations	See Notice below.

NOTICE

Speed changes made using the SET BAUD RATE command are not saved in NVRAM; the monitor returns to 9600 bps after a restart. It is recommended that this command only be used to speed up a serial download, and not to redefine the operational state.

Supported data speeds

The supported data rates, in bps, are:

- 900
- 1050
- 1200
- 1800
- 2000
- 2400
- 3600
- 4800
- 7200
- 9600
- 14400
- 19200
- 28800
- 38400
- 57600
- 115200

D20MX logging

The D20MX provides two logs that are useful for troubleshooting issues:

- WESMAINT Error Log
- Kernel Error Log.

WESMAINT error log

The WESMAINT Error Log stores informational, error, warning, and fatal error messages generated by the system. Refer to B014-1NUG WESMAINT II+ for the D20MX User's Guide for more information.

Most messages logged to the WESMAINT Error Log by an application are described in the application's Configuration Guide For information on messages not available in a Configuration Guide, refer to Appendix H, *WESMAINT Error Log Messages*.

Kernel error log

The Kernel Error Log stores low-level system messages typically required only by GE Digital EnergyTechnical Support to assist with problem diagnosis.

View the Kernel Error Log by typing **el** in the D20MX Shell. Also refer to SWM0080 D20MX Shell User's Guide.

D20MX Substation Controller

Chapter A: Default Role-Based Access Control Model

Configured roles in the D20MX

When you configure the D20MX to use RADIUS, the D20MX must be configured with a set of roles in the B014 RADIUS Roles Table (B014RADR) of the WESMAINT II+ application (Refer to the *B014-1NCG WESMAINT II+ for the D20MX Configuration Guide* for more information). The role is identified by a role ID, which is an integer number provided by the RADIUS server.

The D20MX Default configurations D20MX01-XX and D20MX02-XX include a default role-based access control model that meets the general rules shown in Table 27.

Table 27: General access control rules

Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
Can Change Passwords	Yes	No	No	No
Can Clear the Login Buffer	No	No	No	No
Can Change SCADA Settings	Yes	Yes	No	No
Can Download Firmware	Yes	Yes	No	No
Can Perform Operational Control (e.g. breaker operation)	Yes	Yes	Yes	No
Can View Operational Data	Yes	Yes	Yes	Yes
Can Access Low Level "C" Shell	Yes	No	No	No

The Shell access level roles are provided in Table 28

Table 28: Shell access level

Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
Access Level	Read/Write	Maintenance	Read Only	Read Only

The specific flags defined in the Application Control field of the RADIUS Roles table are provided in the tables listed in Table 29.

Table 29: List of configured roles

Table Number	Access	Flags For...	Associated Application #
Table 30	Modify	WESMAINT	14
Table 31	Read		
Table 32	Modify	D20AC WESMAINT II+ Display Screens	32045
Table 33	Read		
Table 34	Modify	Prologic display	36
Table 35	Read		
Table 36	Modify	DNP DPA Configuration Display	32021
Table 37	Read		
Table 38	Modify	Internet Statistics Display	162
Table 39	Read		
Table 40	Modify	DNP Serial Data Link Display	32013
Table 41	Read		
Table 42	Modify	Modbus DCA Display	59
Table 43	Read		
Table 44	Modify	Modbus DPA Display	68
Table 45	Read		
Table 46	Modify	File Upload Interface	32071
Table 47	Read		
Table 48	Modify	SOE Logger	27
Table 49	Read		
Table 50	Modify	SEL DCA	78
Table 51	Read		
Table 52	Modify	IEC 60870-5-101/104 DPA	101
Table 53	Read		
Table 54	Modify	Landis & Gyr 8979 DPA	185
Table 55	Read		
Table 56	Modify	Harris 6000/XA-21 DPA	199
Table 57	Read		
Table 58	Modify	IEC 60870-5 FT1.2 Balanced Data Link	32085
Table 59	Read		
Table 60	Modify	Modify access flags for DNP V1.00 Data Link	17
Table 61	Read		
Table 62	Modify	Quantum Meter Scanner DCA	18
Table 63	Read		
Table 64	Modify	CDC Type 1 DPA	23
Table 65	Read		
Table 66	Modify	PID DTA	41
Table 67	Read		
Table 68	Modify	MODBUS TCP DCA	131
Table 69	Read		

Table Number	Access	Flags For...	Associated Application #
Table 70	Modify	MODBUS TCP DPA	135
Table 71	Read		
Table 72	Modify	LogicLinx DTA	32082
Table 73	Read		
Table 74	Modify	PML 3710 DCA Display	74
Table 75	Read		
Table 76	Modify	Courier DCA Display	98
Table 77	Read		

Table 30: Modify access flags for WESMAINT (Application number: 14)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Time and Date display	Yes	Yes	Yes	No
1	Peripheral Status display	Yes	Yes	Yes	No
2	Peripheral Status Detail display	Yes	Yes	No	No
3	COS Buffer display	Yes	Yes	Yes	No
4	SHELL	Yes	Yes	Yes	No
5	Digital Inputs display	Yes	Yes	Yes	No
6	Digital Inputs Detail display	Yes	Yes	Yes	No
7	Digital Outputs display	Yes	Yes	Yes	No
8	Digital Outputs Detail display	Yes	Yes	Yes	No
9	Analog Inputs display	Yes	Yes	Yes	No
10	Analog Inputs Detail display	Yes	Yes	Yes	No
11	Analog Outputs display	Yes	Yes	Yes	No
12	Analog Outputs Detail display	Yes	Yes	Yes	No
13	Transition Counter display	Yes	Yes	Yes	No
14	Transition Counter Detailed display	Yes	Yes	Yes	No
15	SOE Buffer display	Yes	Yes	Yes	No
16	USER LOG display	Yes	No	No	No
17	Database Synch display	Yes	Yes	Yes	No
18	Switch-over display	Yes	Yes	Yes	No
19	System Status display	Yes	Yes	No	No
20	Communication Status display	Yes	Yes	No	No
21	Complex Object display	Yes	Yes	No	No
22	Complex Object Detail display	Yes	Yes	No	No
23	Generic Data display	Yes	Yes	No	No
24	Generic Data Detail display	Yes	Yes	No	No
25 - 31	Not used.	Yes	Yes	No	No

Table 31: Read access flags for WESMAINT (Application number: 14)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Time and Date display	Yes	Yes	Yes	Yes
1	Peripheral Status display	Yes	Yes	Yes	Yes
2	Peripheral Status Detail display	Yes	Yes	Yes	Yes
3	COS Buffer display	Yes	Yes	Yes	Yes

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
4	SHELL	Yes	Yes	Yes	Yes
5	Digital Inputs display	Yes	Yes	Yes	Yes
6	Digital Inputs Detail display	Yes	Yes	Yes	No
7	Digital Outputs display	Yes	Yes	Yes	Yes
8	Digital Outputs Detail display	Yes	Yes	Yes	No
9	Analog Inputs display	Yes	Yes	Yes	Yes
10	Analog Inputs Detail display	Yes	Yes	Yes	No
11	Analog Outputs display	Yes	Yes	Yes	Yes
12	Analog Outputs Detail display	Yes	Yes	Yes	No
13	Transition Counter display	Yes	Yes	Yes	Yes
14	Transition Counter Detailed display	Yes	Yes	Yes	No
15	SOE Buffer display	Yes	Yes	Yes	Yes
16	USER LOG display	Yes	Yes	No	No
17	Database Synch display	Yes	Yes	Yes	No
18	Switch-over display	Yes	Yes	Yes	No
19	System Status display	Yes	Yes	Yes	Yes
20	Communication Status display	Yes	Yes	Yes	Yes
21	Complex Object display	Yes	Yes	No	No
22	Complex Object Detail display	Yes	Yes	No	No
23	Generic Data display	Yes	Yes	No	No
24	Generic Data Detail display	Yes	Yes	No	No
25-31	Not used.	Yes	Yes	No	No

Table 32: Modify access flags for D20AC WESMAINT II+ display screens (Application number: 32045)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 33: Read access flags for D20AC WESMAINT II+ display screens (Application number: 32045)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	D20 AC Main Menu	Yes	Yes	Yes	Yes
1	Circuit Display Page	Yes	Yes	Yes	Yes
2	Circuit Configuration Page	Yes	Yes	Yes	Yes
3	D20 AC Configuration Page	Yes	Yes	Yes	Yes
4 – 31	Not Used	Yes	Yes	Yes	No

Table 34: Modify access flags for Prologic display (Application number: 36)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 35: Read access flags for Prologic display (Application number: 36)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Connect to Prologic Editor	Yes	Yes	Yes	No
1	Request Control of Port	Yes	Yes	Yes	No
2 - 31	Not Used	Yes	Yes	Yes	No

Table 36: Modify access flags for DNP DPA configuration display (Application number: 32021)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-23	Not Used	Yes	Yes	Yes	No
24	Modify Points / Detail Displays	Yes	Yes	Yes	No
25-31	Not Used	Yes	Yes	Yes	No

Table 37: Read access flags for DNP DPA configuration display (Application number: 32021)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	DNP DPA Display	Yes	Yes	Yes	Yes
1-22	Not Used	Yes	Yes	Yes	No
23	Configuration Pages	Yes	Yes	Yes	Yes
24	Detail Pages	Yes	Yes	Yes	No
25 - 31	Not Used	Yes	Yes	Yes	No

Table 38: Modify access flags for internet statistics display (Application number: 162)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 39: Read access flags for internet statistics display (Application number: 162)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 40: Modify access flags for DNP serial data link display (Application number: 32013)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 41: Read access flags for DNP serial data link display (Application number: 32013)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 42: Modify access flags for Modbus DCA display (Application number: 59)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 43: Read access flags for Modbus DCA display (Application number: 59)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 44: Modify access flags for Modbus DPA display (Application number: 68)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 45: Read access flags for Modbus DPA display (Application number: 68)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 46: Modify access flags for file upload interface (Application number: 32071)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 47: Read access flags for file upload interface (Application number: 32071)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	yes	No

Table 48: Modify access flags for SOE Logger (Application number: 27)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0-31	Not Used	Yes	Yes	Yes	No

Table 49: Read access flags for SOE Logger (Application number: 27)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 50: Modify access flags for SEL DCA (Application number: 78)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 1	Not Used	Yes	Yes	Yes	No
2	Gateway access to serial port	Yes	Yes	Yes	No
3 - 31	Not Used	Yes	Yes	Yes	No

Table 51: Read access flags for SEL DCA (Application number: 78))

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	Yes
1	Not Used	Yes	Yes	Yes	No
2	Show relay level 1 password	Yes	Yes	No	No
3	Not Used	Yes	Yes	Yes	No
4	Show relay level 2 password	Yes	Yes	No	No
5 - 7	Not Used	Yes	Yes	Yes	No
8	Show MUX level 1 password	Yes	Yes	No	No
9-31	Not Used	Yes	Yes	Yes	No

Table 52: Modify access flags for IEC 60870-5-101/104 DPA (Application number: 101)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Not Used	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 53: Read access flags for IEC 60870-5-101/104 DPA (Application number: 101)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Any Page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 54: Modify access flags for Landis & Gyr 8979 DPA (Application number: 185)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Not Used	Yes	Yes	Yes	No
1	Force / Unforce Point, Delete All or Delete to Cursor in SOE Log Display	Yes	Yes	Yes	No
2	Freeze Accumulator	Yes	Yes	Yes	No
3 - 31	Not Used	Yes	Yes	Yes	No

Table 55: Read access flags for Landis & Gyr 8979 DPA (Application number: 185)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Main Display	Yes	Yes	Yes	Yes
1	Analog Input Display	Yes	Yes	Yes	Yes
2	ADC Reference Display	Yes	Yes	Yes	Yes
3	Indication, SOE or Digital Input Display	Yes	Yes	Yes	Yes
4	Accumulator Display	Yes	Yes	Yes	Yes

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
5	SOE Log Display	Yes	Yes	Yes	Yes
6	Analog Output Display	Yes	Yes	Yes	Yes
7	Digital Output Display	Yes	Yes	Yes	Yes
8	LRU Configuration Display	Yes	Yes	Yes	Yes
9	Cross References Display	Yes	Yes	Yes	Yes
10 - 31	Not Used	Yes	Yes	Yes	No

Table 56: Modify access flags for Harris 6000/XA-21 DPA (Application number: 199)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Not Used	Yes	Yes	Yes	No
1	Not Used	Yes	Yes	Yes	No
2	Not Used	Yes	Yes	Yes	No
3	Force Digital Output (Digital Output Display)	Yes	Yes	Yes	No
4	Not Used	Yes	Yes	Yes	No
5	Not Used	Yes	Yes	Yes	No
6	Force Analog Output (Analog Output Display)	Yes	Yes	Yes	No
7	Force R/L Output (R/L Outputs Display)	Yes	Yes	Yes	No
8	Delete All COS (COS Display)	Yes	Yes	Yes	No
9	Delete All SOE (SOE Display)	Yes	Yes	Yes	No
10 - 31	Not Used	Yes	Yes	Yes	No

Table 57: Read access flags for Harris 6000/XA-21 DPA (Application number: 199)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Main Display	Yes	Yes	Yes	Yes
1	Port Assignment and Cross References Displays	Yes	Yes	Yes	Yes
2	Current Status Display	Yes	Yes	Yes	Yes
3	Digital Output Display	Yes	Yes	Yes	Yes
4	Accumulator Display	Yes	Yes	Yes	Yes
5	Analog Input Display	Yes	Yes	Yes	Yes
6	Analog Output Display	Yes	Yes	Yes	Yes
7	R/L Outputs Display	Yes	Yes	Yes	Yes
8	COS Display	Yes	Yes	Yes	Yes
9	SOE Display	Yes	Yes	Yes	Yes
10 - 31	Not Used	Yes	Yes	Yes	No

Table 58: Modify access flags for IEC 60870-5 FT1.2 Balanced Data Link (Application number: 32085)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Not Used	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 59: Read access flags for IEC 60870-5 FT1.2 Balanced Data Link (Application number: 32085)

Bit Position	Description	Administrator [2]	Engineer [1]	Operator [3]	Observer [0]
0	Any Page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 60: Modify access flags for DNP V1.00 Data Link (Application number: 17)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Update counters in the DNP Comm. Statistics Display	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 61: Read access flags for DNP V1.0 Data Link (Application number: 17)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	DNP Comm. Statistics Display	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 62: Modify access flags for Quantum Meter Scanner DCA (Application number: 18)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 1	Not Used	Yes	Yes	Yes	No
2	Update counters in Quantum Meter Status Display	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 63: Read access flags for Quantum Meter Scanner DCA (Application number: 18)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Quantum Function Menu	Yes	Yes	Yes	Yes
1	Quantum Meter Data Display	Yes	Yes	Yes	Yes
2	Quantum Meter Status Display	Yes	Yes	Yes	Yes
3 - 31	Not Used	Yes	Yes	Yes	No

Table 64: Modify access flags for CDC Type 1 DPA (Application number: 23)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 31	Not Used	Yes	Yes	Yes	No

Table 65: Read access flags for CDC Type 1 DPA (Application number: 23)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Main Menu	Yes	Yes	Yes	No
1 - 8	Not Used	Yes	Yes	Yes	No
9	Accumulators Display, Analog Inputs Display, Direct Analog Outputs Display, SBO Analog Outputs Display, Direct Controls Display, SBO Controls Display, Status Inputs Display, Direct Setpoints Display, and SBO Setpoints Display	Yes	Yes	Yes	No
10 - 31	Not Used	Yes	Yes	Yes	No

Table 66: Modify access flags for PID DTA (Application number: 41)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 31	Not Used	Yes	Yes	Yes	No

Table 67: Read access flags for PID DTA (Application number: 41))

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any page	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 68: Modify access flags for the MODBUS TCP DCA (Application number: 131)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 31	Not Used	Yes	Yes	Yes	No

Table 69: Read access flags for the MODBUS TCP DCA (Application number: 131)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 70: Modify access flags for the MODBUS TCP DPA (Application number: 135)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 31	Not Used	Yes	Yes	Yes	No

Table 71: Read access flags for the MODBUS TCP DPA (Application number: 135)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

Table 72: Modify access flags for the LogicLinx DTA (Application number: 32082)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	SSH Port Forward Connect	Yes	Yes	No	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 73: Read access flags for the LogicLinx DTA (Application number: 32082)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Wesmaint Connect	Yes	Yes	No	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 74: Modify access flags for PML 3710 DCA (Application number: 74)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 31	Not Used	Yes	Yes	Yes	No

Table 75: Read access flags for PML 3710 DCA (Application number: 74)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	No
1 - 31	Not Used	Yes	Yes	Yes	No

Table 76: Modify access flags for Courier DCA (Application number: 98)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0 - 31	Not Used	Yes	Yes	Yes	No

Table 77: Read access flags for Courier DCA (Application number: 98)

Bit Position	Description	Administrator (2)	Engineer (1)	Operator (3)	Observer (0)
0	Any Page	Yes	Yes	Yes	Yes
1 - 31	Not Used	Yes	Yes	Yes	No

D20MX Substation Controller

Appendix B: Standards & Protection

This Appendix lists the standards with which the D20 have been tested for compliance.

Compliance standards

Compliance standards are listed for the following categories:

- Emission standards; see Table 78
- Immunity standards; see Table 79
- Safety publications; see Table 80
- Environmental standards; see Table 81

Table 78: Emission standards

Standard Name	Description	D20 Test Specification
EN55011 (CISPR 11)[1]	ISM RF equipment – Electromagnetic disturbance characteristics	Radiated Emissions 30 MHz to 1 GHz Conducted Emissions 150 kHz – 30 MHz

Table 79: Immunity standards

Standard Name	Description	D20 Test Specification
IEC 61000-4-2	Electrostatic discharge (ESD) immunity test	Contact Discharge: 8 kV Air Discharge: 15 kV HCP and VCP: 8 kV
IEC 61000-4-3 IEC 61850-3: clause 5.7.2	Radiated, radio-frequency electromagnetic field immunity test	80 MHz to 1 GHz: 10V/m 1.4 GHz to 2 GHz: 3V/m 2 GHz to 3 GHz: 1V/m
IEC 61000-4-4 IEC 61850-3: clause 5.7.1.4	Electrical fast transient/burst immunity test	Direct Couple: 4 kV/5 kHz Capacitive Clamp: 2 kV/5 kHz
IEC 61000-4-5	Surge immunity test	Power port 2kV Signal port 2kV
IEC 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields	150 kHz to 80 MHz: 10Vrms

Standard Name	Description	D20 Test Specification
IEC 60255-22-1	1 MHz burst immunity test	Pass
IEC 61000-4-8	Power frequency magnetic field immunity test	100A/m @ 180s 1000A/m @ 3s
IEC 61000-4-12	Ring wave	Pass
IEC 61000-4-11	Voltage dips, short interruptions and voltage variations immunity tests	Pass
IEC 61000-4-16 IEC 61850-3: clause 5.7.1.3	Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz	30Vrms, 300Vrms
IEC 61000-4-17	Ripple on DC input power port immunity test	Pass
IEC 61000-4-29+	Voltage dips, short interruptions and voltage variations on DC input power port immunity test This standard only applies when using high voltage DC as the source (100 V DC to300 V DC).	Pass

Table 80: Safety publications

Standard Name	Description	D20 Test Specification
IEC 61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use - General requirements	
IEC 60255-5	Insulation coordination for measuring relays and protection equipment-Requirements and tests	Dielectric and Resistance measurements not applicable due to design (TVS in circuit)

Table 81: Environmental standards

Standard Name	Description	D20 Test Specification
IEC 60068-2-1	Cold	96 hours powered at - 20 °C
IEC 60068-2-2	Dry Heat	96 hours powered at + 70 °C
IEC 60068-2-6	Vibration (sinusoidal)	A logarithmic sweep from 10 Hz to 150 Hz to 10 Hz at 1 oct/min for 1 sweep cycle in the 3 orthogonal axes. Acceleration level 1 g
IEC 60068-2-27	Shock - Operating Response Test Shock - Non-Operating Withstand Test	- Operating Response Test: Acceleration level: 5 g's - Non-Operating Withstand Test: Acceleration level: 15 g's 3 pulses per polarity per axis for a total of 18 pulses
IEC 60068-2-29	Bump – Non operating test	10g peak, 1000 pulses per polarity per axis for a total of 6000 pulses
IEC 60068-2-30	Damp heat, cyclic (12 h + 12 h cycle)	96 hours humidity at +25 °C / +55 °C at 95% RH
IEC 60068-2-31	Drop and topple	50 mm drop on 4 edges and 4 faces
IEC 60068-2-78	Humidity Testing	96 hours steady state humidity at 40 °C and 93% RH

1 To comply, the ferrite clamp (460-0073) supplied must be installed on the power cable.

D20MX Substation Controller

Appendix C: Frequently Asked Questions

This appendix answers some frequently and commonly asked D20MX questions:

- Why is a D20MX RTU important?
- How does configuration storage work in the D20MX?
- Why does the D20MX use the Vxworks Operating System instead of pSOS?
- Is the D20MX hardware backward compatible?
- Are the PCOMMON versions compatible with the D20MX?
- What is the recommended operating temperature range of the D20MX?
- What software application is used to configure a D20MX configuration?
- Can you migrate an old D20 configuration to D20MX?
- What comprises a typical D20MX firmware upgrade?
- How do you upgrade the low-level firmware components of a D20MX?
- Can you migrate an old D20 configuration to D20MX?
- What comprises a typical D20MX firmware upgrade?
- How do you upgrade the low-level firmware components of a D20MX?
- What comprises a typical D20MX firmware upgrade?
- Is Active Directory integration possible?
- How are communications authenticated?
- How are communication authorized?
- Are communications encrypted?
- If remote management/configuration is possible, how is it secured?
- Describe steps taken to harden the system?

Questions and answers

Q: Why is a D20MX RTU important?

A: The D20MX is being introduced for the following reasons:

- Some electronic components used in the D20 products have reached their end-of-life; For example, the 68EC030 CPU in the D20ME II and D20ME boards.
- VXworks is the new operating system for the D20MX; this is more robust for D20 applications.
- The D20MX offers Cyber Security features that are intended for critical infrastructure protection within the power system. This is required for Electric Reliability Compliance.
- The D20MX is a modern platform that is capable of handling current and future processing needs, particularly for security.
- The D20MX has 1 GB of RAM, compared to 1 MB RAM in the D20ME.
- The D20MX has 16 MB of built-in NVRAM, compared to the 512 KB of NVRAM available in its predecessor. Subsequently, there is no need for additional memory expansion modules.
- The firmware flash memory size in the D20MX is 128 MB, compared to the 2 MB of its predecessor.
- The D20MX uses a Super Capacitor which allows the system clock to be saved for 14-days even after power off.

Q: How does configuration storage work in the D20MX?

A: The Super capacitor strictly allows the retention of the system clock time for 14-days. At power-up, the configuration resides in the RAM. At power-down, configuration resides in the flash. This is possible due to the seamless transaction between the RAM and flash. This arrangement protects the D20MX configuration from being lost, even after power-down for an indefinite period of time.

Q: Why does the D20MX use the Vxworks Operating System instead of pSOS?

A: Vxworks is designed for mission critical systems. It is purpose-fit, extremely robust and fast. It is industry-focused and designed from the ground-up to be a real-time operating system. It is the new operating system of choice for numerous embedded systems that require a high level of robustness.

A: Embedded systems manufacturers are moving away from the pSOS operating system since on-going support for this operating system is very limited.

Q: Is the D20MX hardware backward compatible?

A: The D20MX hardware is compatible with the I/O modules installed in the field.

A: Due to aging printed circuit board assembly and mechanical constraints, only certain chassis from 2002 and onward can be used with a D20MX. This comprises the following chassis:

- D20 VME chassis 500-0280 Release 08 or higher

  For the VME chassis 500-0280, the zero volt cable supplied with the D20MX KIT, must be connected from the zero volt TB2 terminal block on the 517-0225 to zero volt on the 517-0123. Review the hardware manual for the steps involved. Part number for the zero volt wire cable is 975-1237.
- D20 Non-VME chassis 500-0305 Release 18 or higher

Q: Are the PCOMMON versions compatible with the D20MX?

A: The following PCOMMON versions are compatible with the D20MX:

- P022 v3.06, v3.05 and 3.00: PCOMMON for D20C
  Note: v3.06 is required if fiber optic repeaters / splitters are used.
- P010 v3.06, 3.05, 3.01 and 3.00: PCOMMON for D20A, D20S and D20K
- P087 v1.04, 1.03 and 1.02: pBOOT for D20AC

A: Also see the PCOMMON versions compatible with the D20MX in Table 13 on page 57.

Q: What is the recommended operating temperature range of the D20MX?

A: The operating temperature range is 0°C to +70°C.

Note: Do not operate the D20MX above 60°C for extended periods of time as this shortens the life of the super capacitor and reduces the backup time of the real time clock.

Q: What software application is used to configure a D20MX configuration?

A: The SGConfig (version 8.1 or higher) offline configuration tool is used to configure the D20MX. SGConfig is similar to ConfigPro which is used to program its predecessor.

Q: Can you migrate an old D20 configuration to D20MX?

A: ConfigPro is partly used to get the D20 device configuration ready for migration into the SGConfig tool.

A: It is recommended to migrate a project rather than a device to prevent partial loss of configuration data related to Ethernet/LAN.

A: For detailed migration steps, see section “Transfer D20/D200 configurations to the D20MX” on page 91.

Q: What comprises a typical D20MX firmware upgrade?

A: Typically a firmware upgrade of the D20MX involves only the operating system and application firmware images, which are transferred by SFTP.

Q: How do you upgrade the low-level firmware components of a D20MX?

A: To upgrade the low-level firmware components (i.e., Bootrom, FPGA or JMON) of a D20MX run a TFTP client from the JMON prompt of the D20MX. Upgrading of these low-level firmware components is seldom required.

Q: What comprises a typical D20MX firmware upgrade?

A: Typically a firmware upgrade of the D20MX involves only the operating system and application firmware images, which are transferred by SFTP.

Q: Is Active Directory integration possible?

A: Yes. Since the D20MX supports RADIUS, the D20MX can be integrated with Active Directory through the Microsoft RADIUS Servers: Network Policy Server when using Windows Server 2008 or 2012 or Internet Authentication Service when using Windows Server 2003. Refer to SWM0076 or SWM0075 for details.

Q: How are communications authenticated?

A: Network Communications

RADIUS or the local password store provides authentication for the following network access types: Wesmaint II+ / console access, LogicLinx debugging and configuration, firmware transfer.

Network SCADA protocols are currently not authenticated, but this is a limitation of the protocol rather than the D20MX. Protocols such as DNP SAv5 which do provide authentication are on the road-map for the D20MX.

A: Serial Communications

RADIUS or the local password store provides authentication for the following serial access types: Wesmaint II+ / console access, LogicLinx debugging and configuration/ firmware transfer.

Serial SCADA protocols are currently not authenticated, but this is a limitation of the protocol rather than the D20MX. Protocols such as DNP SAv5 which do provide authentication are on the road-map for the D20MX.

Q: How are communication authorized?

A: Network Communications

RADIUS or the local configuration user database provide authorization for the following network access types: Wesmaint II+ / console access, LogicLinx debugging, and configuration/firmware transfer. Authorization is provided for four roles: Administrator, Engineer, Operator and Observer.

Authorization for network SCADA protocols is currently not provided, but this is a limitation of the protocol rather than the D20MX. Protocols such as DNP SAv5 which do provide authorization are on the road-map for the D20MX.

A: Serial Communications

RADIUS or the local configuration user database provide authorization for the following serial access types: Wesmaint II+ / console access, LogicLinx debugging and configuration/firmware transfer. Authorization is provided for four roles: Administrator, Engineer, Operator and Observer.

Authorization for serial SCADA protocols is currently not authenticated, but this is a limitation of the protocol rather than the D20MX. Protocols such as DNP SAv5 which do provide authorization are on the road-map for the D20MX.

Q: Are communications encrypted?

A: Network communication for the following network access types are encrypted: Wesmaint II+ / console access, LogicLinx debugging, and configuration/firmware transfer. RADIUS authentication messages are also encrypted if PEAP/EAP-TTLS is used.

Q: If remote management/configuration is possible, how is it secured?

A: Remote management/configuration is possible. It is secured by means of SSH, with Authentication/Authorization as previously described.

Q: Describe steps taken to harden the system?

A: The system has been hardened by:

- Performing Coverity static analysis and correcting issues on key applications.
- Running Spirent and Wurldtech network security test suites on every release. (Fiber D20MX model is Achilles L1 certified.)
- Running Automatak DNP / Modbus Fuzzers on every release.
- Regularly performing Impact assessments on published vulnerabilities. If impacted, open/closed source is updated to address vulnerabilities and provided in next D20MX release.
- Enabling Operating System features that promote security such as kernel hardening.

D20MX Substation Controller

Appendix D: Using ConfigPro with D20MX

While SGConfig is recommended for configuring and transferring a D20 configuration to the D20MX, it is also possible to configure the D20MX using ConfigPro.

This appendix describes how to transfer a D20 configuration to the D20MX using ConfigPro.

Refer to the “Application definition files and default configurations” on page 172 to see how application definition files and factory default configuration files can be installed.

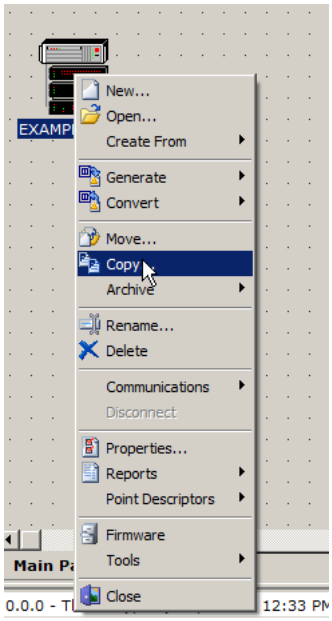
Using ConfigPro to configure and transfer a D20 configuration to a D20MX is done by:

- “Transferring D20 configurations to the D20MX” on page 150
- “Downloading a D20MX configuration” on page 163

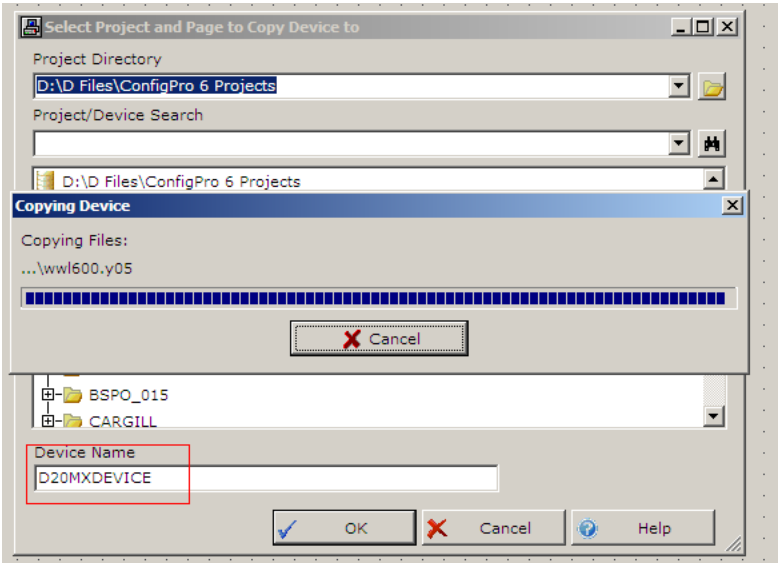
Transferring D20 configurations to the D20MX

To transfer a D20 configuration to the D20MX using ConfigPro:

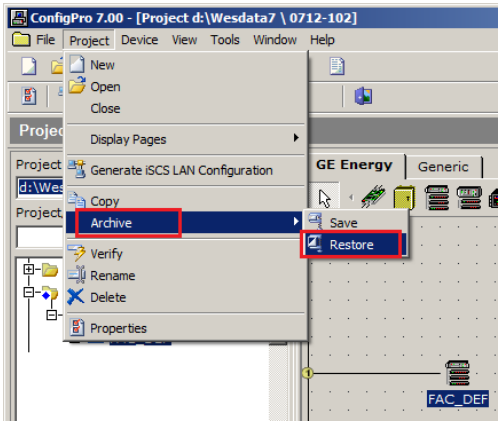
1. Create a D20MX device.
   1.1. Right-click the D20 device.
   1.2. Select **Copy...**.
   Result: The **Select Project and Page to Copy Device to** window appears.



   1.3. In the **Device Name** field, rename the device as a D20MX device.

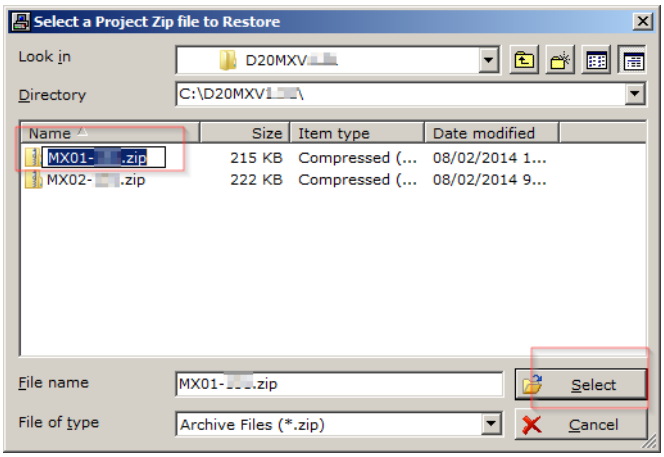


2. Generate a report of the applications in the original D20 device configuration and determine the unused applications.
   2.1. Right-click on the created D20MX device and select **Reports** > **Application List**.
   Result: The Select Reports dialog appears with the Application List report selected.
   2.2. Click **Setup**.
   Result: The Print Setup dialog appears.
   2.3. Select a printer in the **Name** field if the Name field is empty.
   Result: A printer is selected in the Name field.
   2.4. Click **OK** and **OK**.
   Result: A new tab named Application List opens and contains the Application List report for the original D20 device.
   2.5. Compare the Application List report with Table 2 D20MX application definitions on page 16. With the exception of LAN Redundancy Manager (B119-1N), note the applications that appear in Table 2 but not in the report. You may want to print Table 2 and mark these applications. These applications are referred to as "unused" applications in the steps to follow.
   2.6. Click the Door icon to close the Application List report.
   Result: The project containing the created D20MX device reappears.
3. Edit the device properties of the created D20MX device so that it uses an appropriate D20MX SAN firmware file and it has similar device properties to the desired D20MX factory default configuration.
   The D20MX SAN firmware files exist in two forms:
   – SAN0001 contains the latest versions of all applications and should be used in all new configurations.
   – SAN0002 contains older versions of the Mailbox DTA [B009] and DNP v3.00 DPA [B021] and is required for systems with older applications. If transferring configurations containing B009 versions less than or equal to 310 and B021 versions less than or equal to 912, use the file SAN0002 firmware. For more details, see Table 2, "D20MX applications," on page 19.
   3.1. Select the factory-based D20MX configuration file to be restored.
   3.1.1. Right-click the D20MX device.
   3.1.2. Select **Archive** > **Restore**.
   Result: The Select a Device Zip file to Restore window appears.



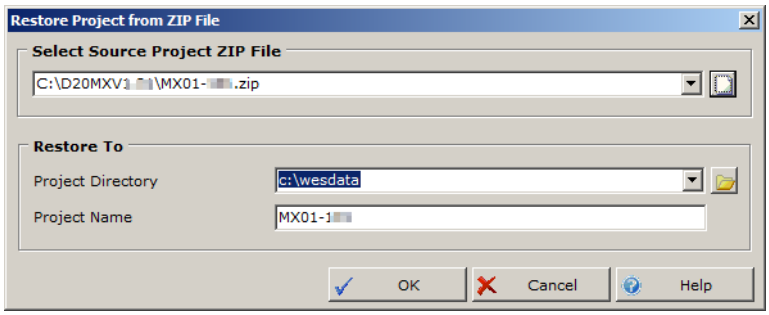
3.1.3. Navigate to the factory default configuration files which were staged previously.

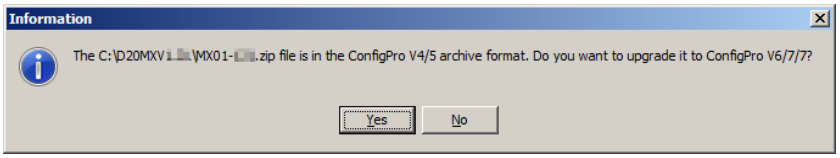
The listed factory-default configuration files with a .zip extension were built with ConfigPro.



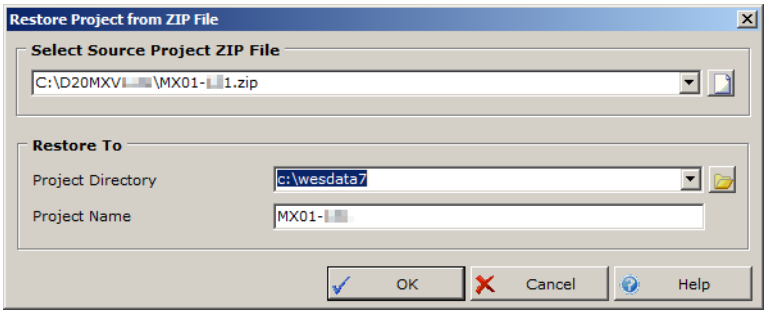
3.2. Select a project location to which the configuration file is to be restored.

Note: The D20MX factory default configuration files are ConfigPro 5 based. If using ConfigPro 6 or 7, when prompted to upgrade, select **Yes**.





If a message indicates that a nested loop [project] is to be created, choose a different Project directory as required: e.g., C: drive in the screen capture that follows.

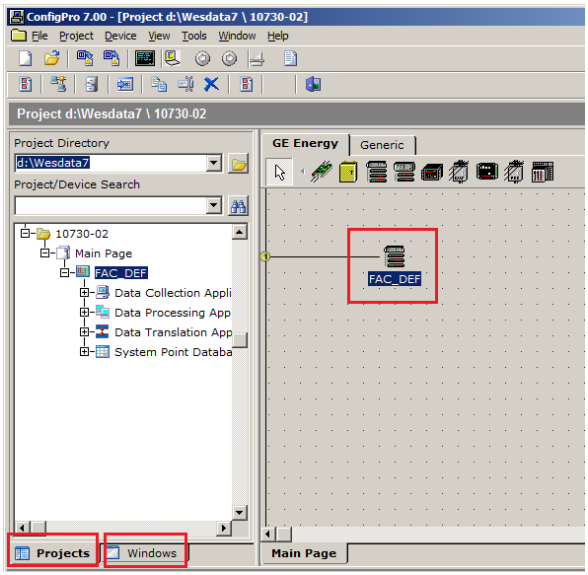


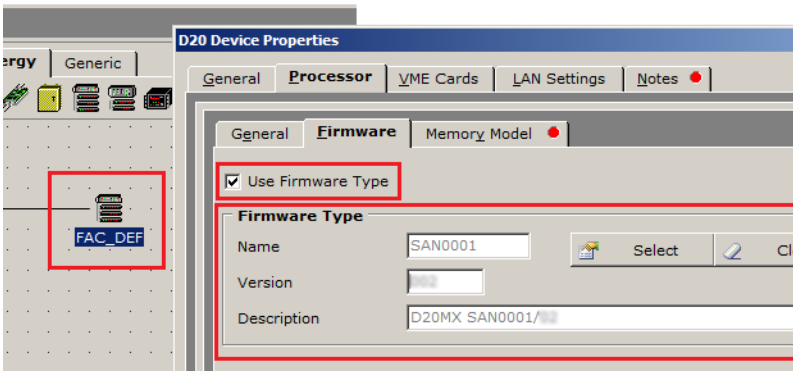
3.3. Open the restored factory default configuration file.

3.3.1. Navigate to the project directory where the factory default configuration was restored.

3.3.2. Open the file.

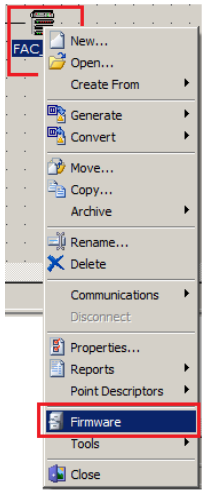
3.3.3. Use the **Projects** and **Windows** tab to switch screen content. The Windows tab allows access to different projects.



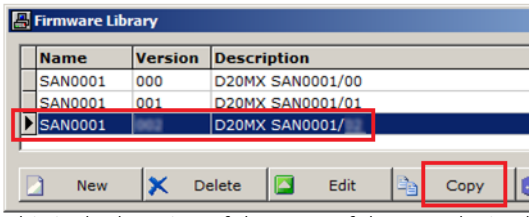


As shown above, the device properties of the factory default configuration **MX01** uses **SAN0001**.

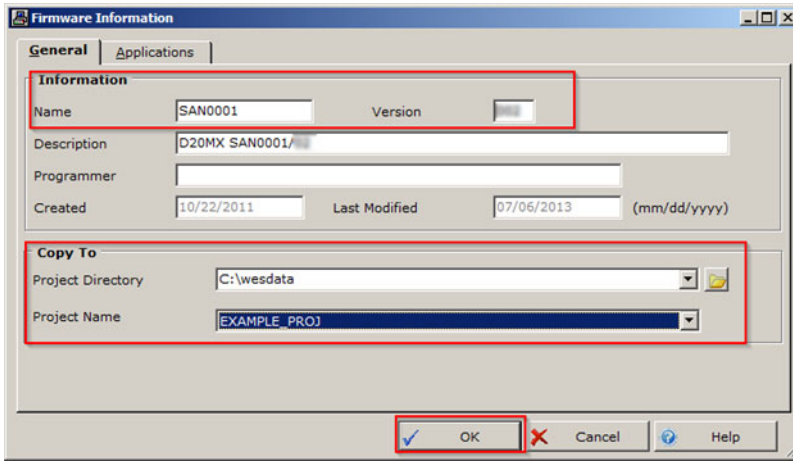
3.3.4. Right-click on the factory default configuration's main page and select **Firmware**.



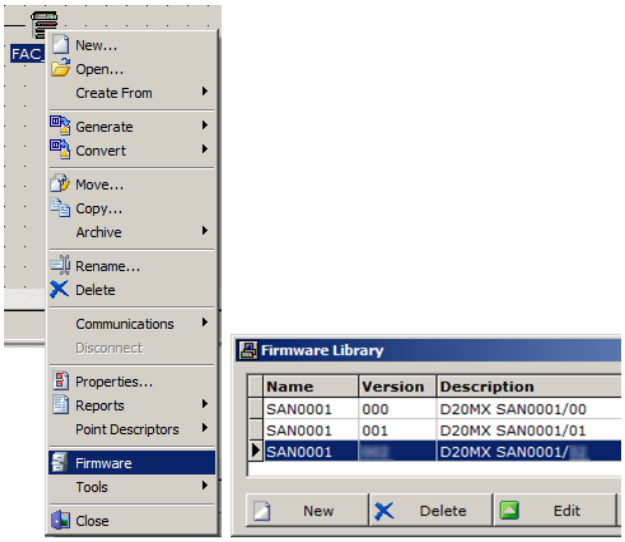
3.3.5. Select the required SAN firmware and click **Copy** to transfer this firmware to the project location in step 1.



This is the location of the copy of the D20 device being modified. In step 1, this D20 device was copied and renamed as a D20MX device.



Result: The D20MX device location now has a firmware library that contains the SAN firmware transferred from the previous step.

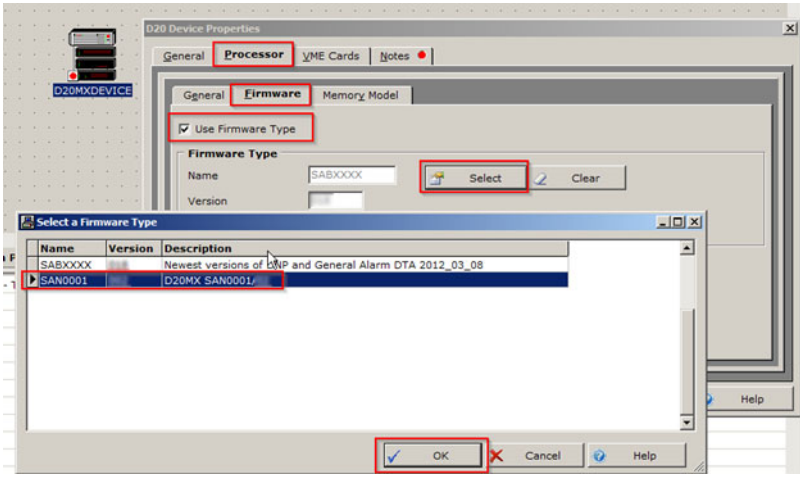


3.4. Select the D20MX device created in step 1 [copied and renamed D20 device], which is to use the intended SAN firmware in the firmware library.

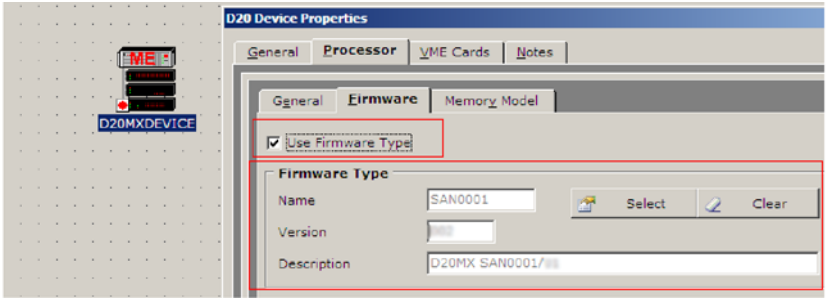
3.4.1. Right-click on the D20MX device.

3.4.2. Select the **Processor** tab > **Firmware** tab > Use **Firmware Type** checkbox to choose the SAN0001 firmware.

Result: The Select a Firmware Type window appears. Click **OK**.

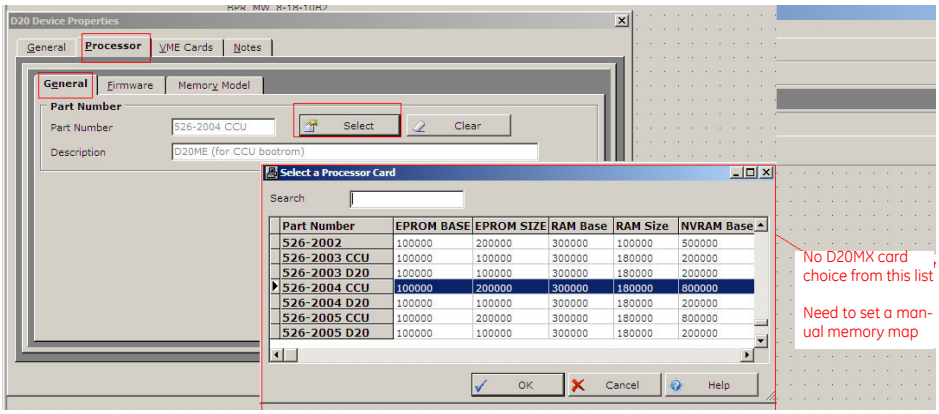


3.4.3. Confirm the SAN0001/SAN0002 firmware is now associated to the D20MX device (from step 1).

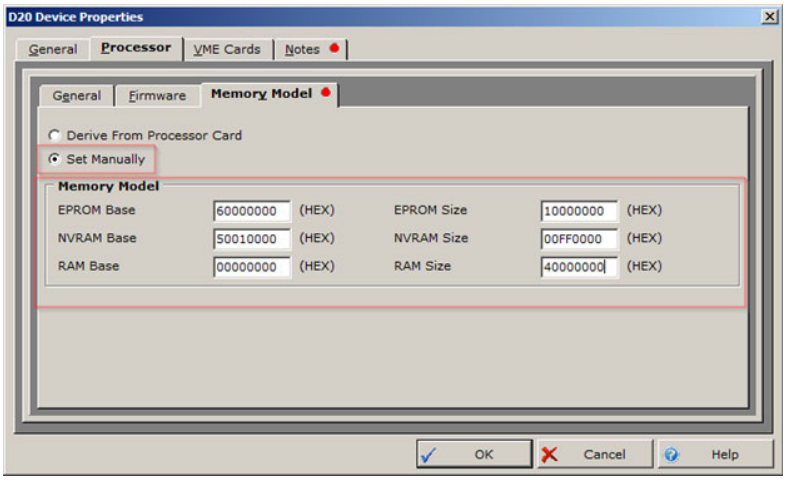


3.5. Manually set the D20MX processor card.

Note: In the same device properties, the General tab does not include a D20MX processor card.



3.5.1. Manually set the memory model in the D20MX device being modified by selecting the **Processor** tab > **Memory Model** tab > **Set Manually** option.



Use the memory model settings from the factory default configuration as a reference, See the table below.

D20MX Processor Memory Model - Set Manually			
EPROM Base	60000000 [HEX]	**EPROM Size**	10000000 [HEX]
NVRAM Base	50010000 [HEX]	**NVRAM Size**	00FF0000 [HEX]
RAM Base	00000000 [HEX]	**RAM Size**	40000000 [HEX]

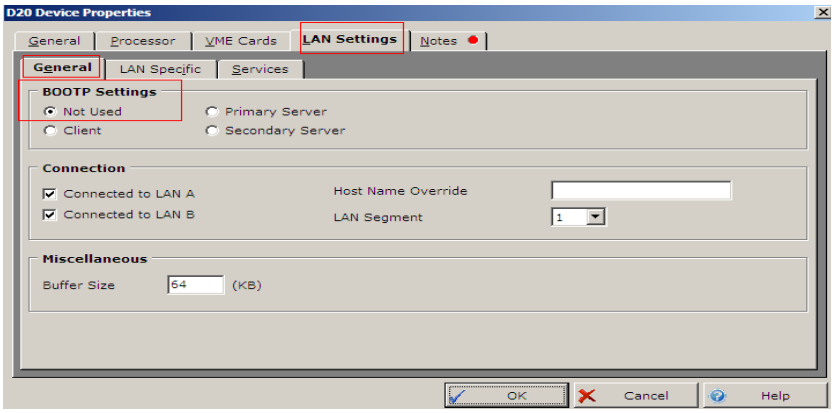
NOTE

Step 3.6 is applicable if the device configuration were a "LAN-based Device" configuration. LAN-based device in the device properties must first be selected under the main General tab. It is impossible to have a LAN-based device unless the project itself is a LAN-based project with all network addresses and settings clearly defined for LAN A and optionally B. Step 3.6 assumes that the reader is familiar with the complete ConfigPro LAN settings configuration steps and that these steps have already been considered. It points out the D20MX factory default LAN-settings.

3.6. Set the LAN Settings.

Default LAN-Based Important Settings: Notice that the D20MX factory default configurations are LAN-based. This is because the hardware of the D20MX RTU has built-in LAN functionality by default. Subsequently, no extra Media Interface Card or EME card is needed.

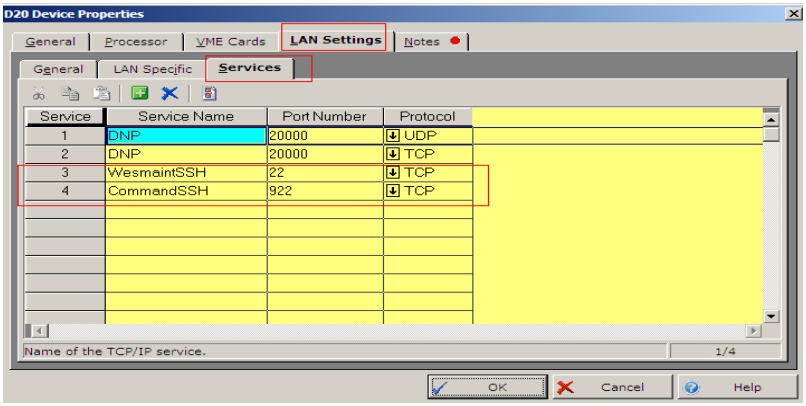
3.6.1. For LAN-based D20MX configurations, ensure that the **BOOTP Settings** option is disabled; select the **Not Used** option.



3.6.2. The **Services** settings highlighted below are used for remote connection into the RTU. If not included in the Services settings, the defaults for WesmaintSSH and CommandSSH are 22 and 922 respectively. If included, these ports can be changed to customized numbers:

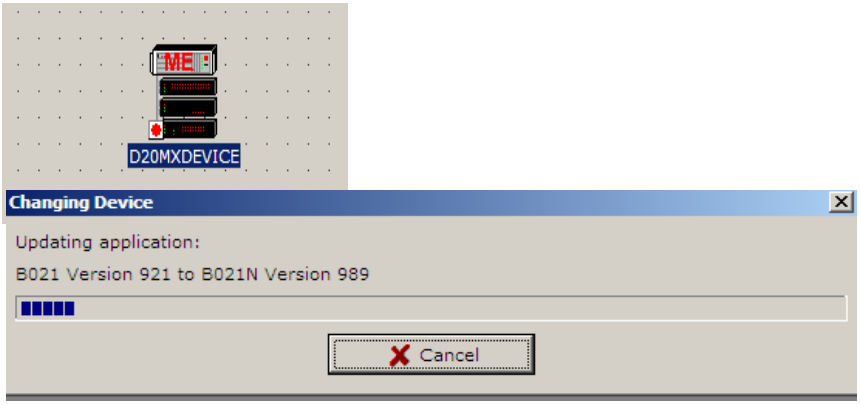
- **WesmaintSSH** allows remote access to the wesmaint menu.
- **CommandSSH** allows remote access to SFTP and the D20M shell.

These are both TCP connections.



4. Click **OK** when the D20MX device properties are set.

Result: The applications present in the SAN firmware are applied to this new D20MX device.

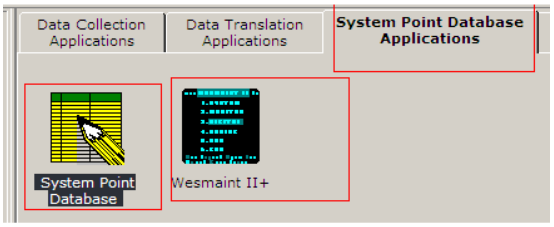


5. Carefully configure the applications of interest before generating the tables for the D20MX device. Disable unused applications. as determined from step 2.

   5.1. In the D20MX device from step 1, disable the unused applications identified in step 2.

   In addition, disable B119-1N LAN Redundancy Manager if the device is not LAN-based.

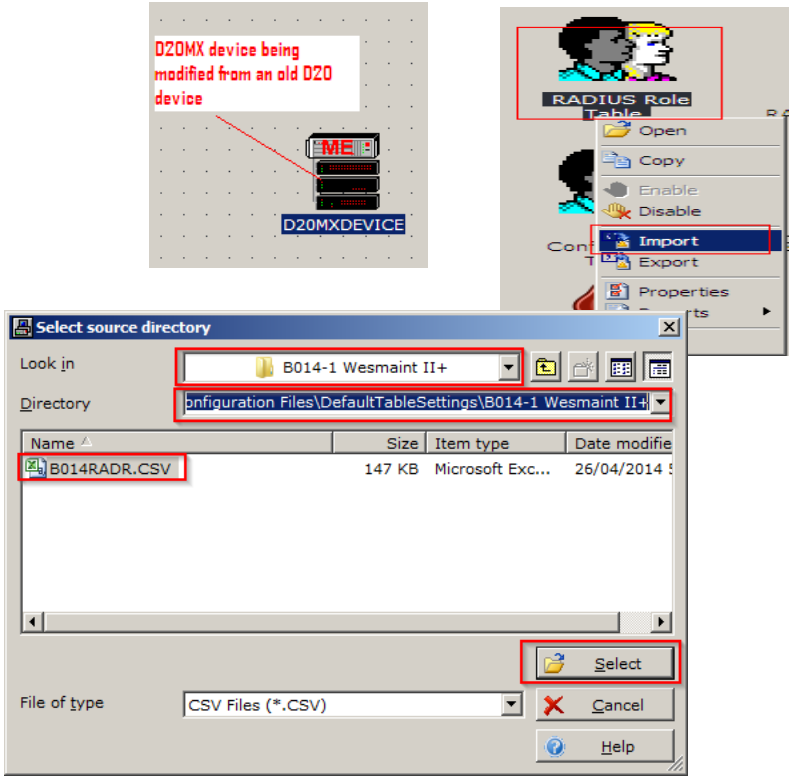
   5.2. Configure the Wesmaint II+ [B014-1N] and System Point Database [B008-1] applications.



   5.3. Configure the new **Wesmaint II [B014-1N] application** referring to its configuration guide. There are new tables and security settings that are required to be configured. For complete details, refer to the D20MX Documentation CD or extracted zip file for the B014-1N configuration guide.

   5.3.1. While in the D20MX device created in step 1, double-click and go to the **System Point Database** tab which contains the Wesmaint II+ application. Right-click on the **RADIUS Role Table** [B014RADR] and import the B014RADR settings.

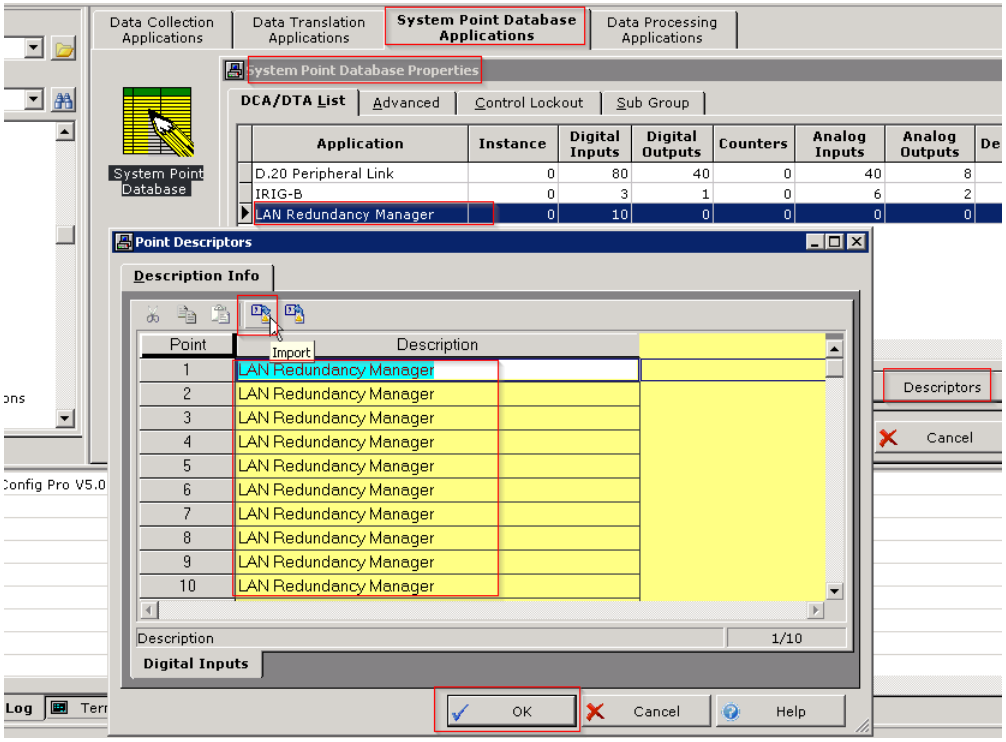
   Navigate to the DVD/CD drive or the ISO Image sub-folder nested two levels into the folder extracted from the D20MX Documentation CD zip file. Then navigate to **Configuration Files** > **DefaultTableSettings** > **B014-1 Wesmaint II+**. Select the file named B014RADR.CSV, and click **Select**.



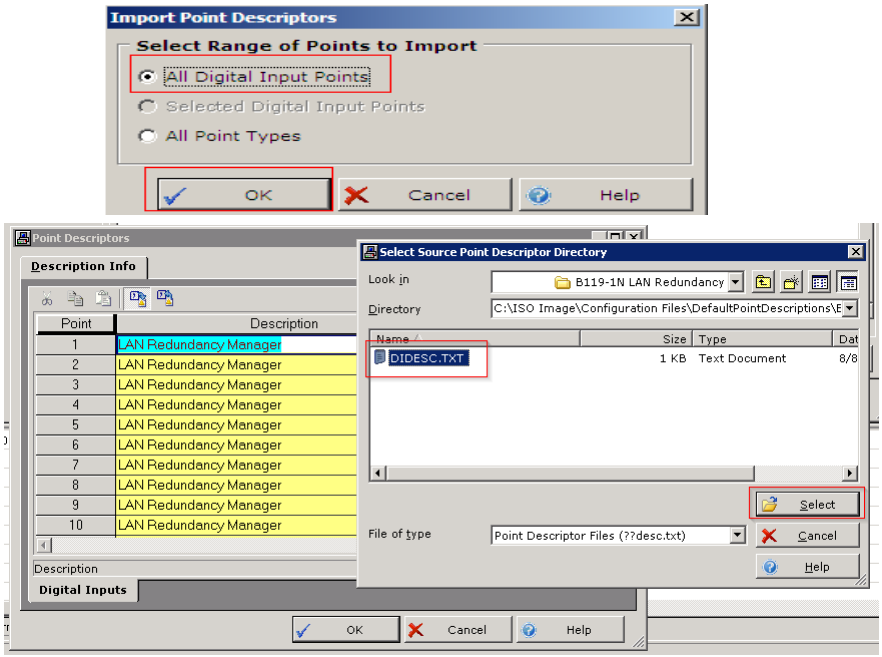
5.4. Configure the LAN Redundancy Manager (B119-1N) application.

Note: If the LAN Redundancy Manager (B119-1N) application in the **Data Translation Applications** tab is enabled, its pseudo point descriptions must be correctly set. Complete the following steps to ensure this.

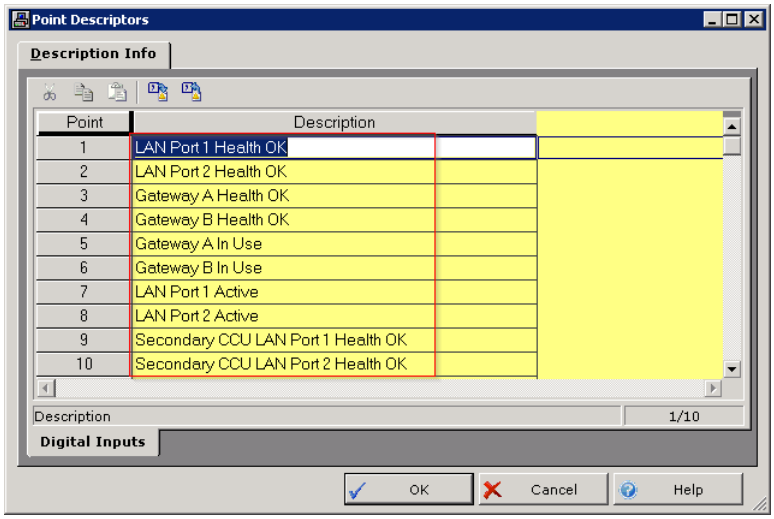
5.4.1. Go to the D20MX device being modified. Double-click the device. Navigate to the **System point database Applications** tab. Double-click the **System Point Database** application. Select the **LAN Redundancy Manager** from the list of applications. Click **Descriptors**. Click the Import icon.



5.4.2. Click **OK**. Then, navigate to the DVD/CD drive or the **ISO Image** sub-folder nested two levels into the folder extracted from the D20MX Documentation CD zip file. Then, navigate to **Configuration Files** > **DefaultPointDescriptions** > **B119-1N LAN Redundancy Manager**. Select **DIDESC.TXT** and click **Select**.



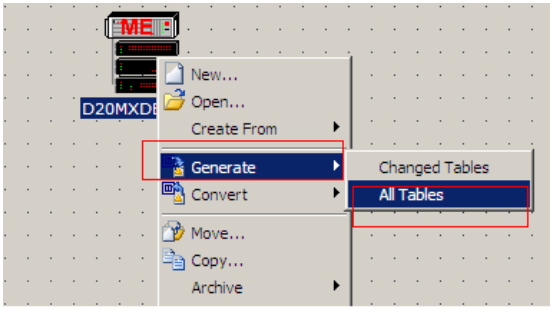
5.4.3. Confirm the pseudo point descriptions changed as shown below. Click **OK** to accept the change and to close each window.

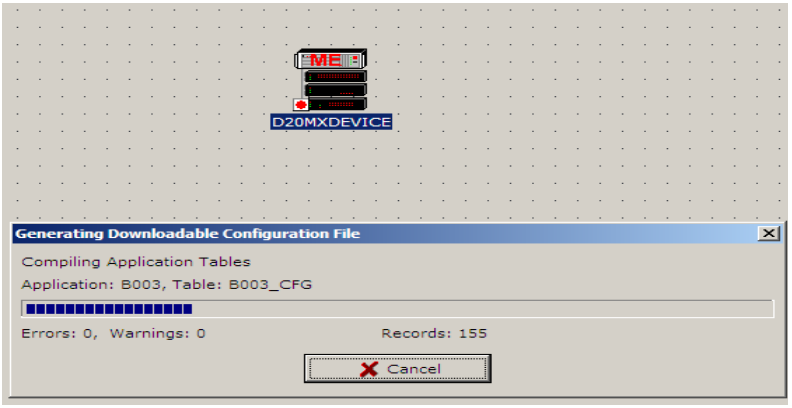


5.4.4. Carefully configure all other enabled applications based on their respective configuration guides. This is required before a configuration can be successfully generated without errors.

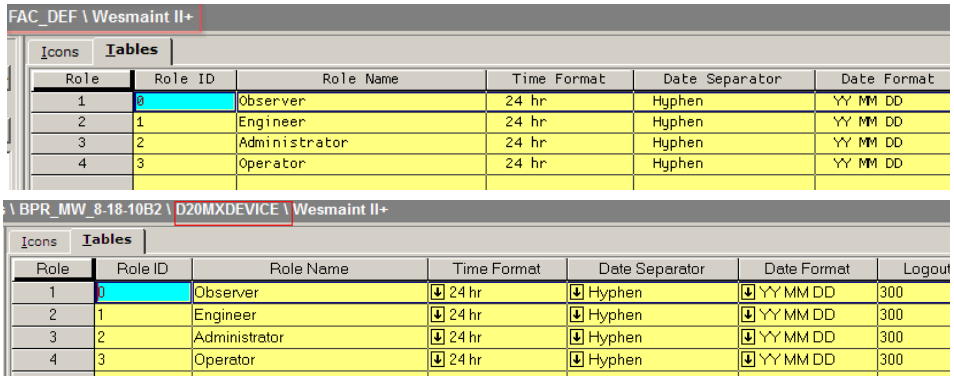
5.4.5. Right-click the device and generate all the tables of the device. Carefully review and resolve all error and warnings.

Note: A red dot on a device indicates that the device's tables need to be generated. Unresolved errors makes the red dot remains





5.4.6. Open up the device and go to the Wesmaint II+ application to compare the RADIUS Role [RADR] tables in the factory default D20MX device with that in the newly modified D20MX device. Compare the first two columns [**Role ID** and **Role Name**] as shown below to confirm the import was successful. If not, repeat the import process.



6. Generate the device configuration, after a configuration has been properly configured.

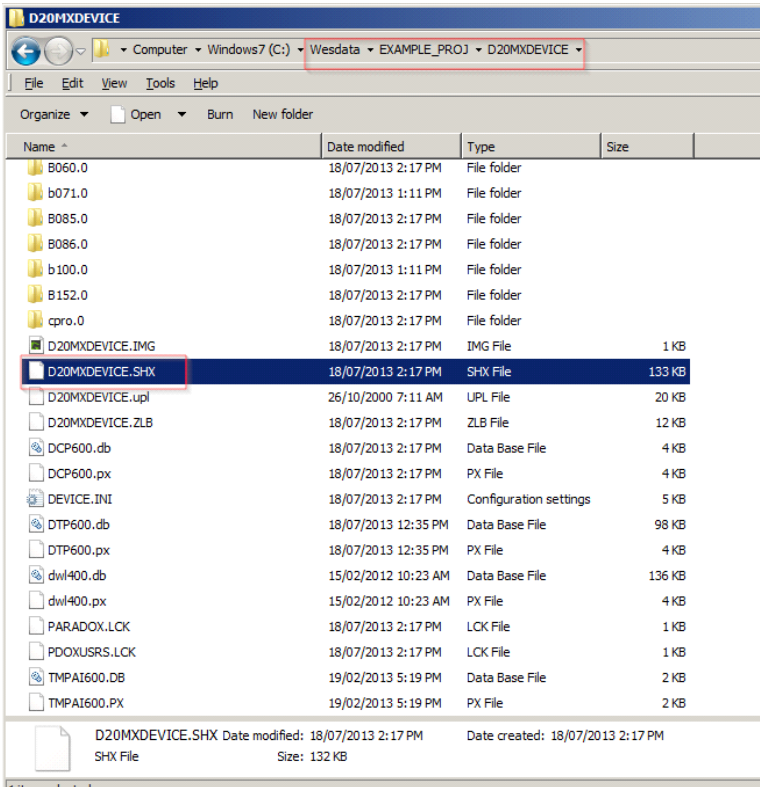
   Result: If there are no errors or warnings, the red dot on the device should not appear and the generated device is ready to be downloaded into the D20MX RTU.

7. The transfer of a D20 configuration into a D20MX configuration is complete.

Configuration file in project directory

NOTE

In step 5.4.5, a **D20MXDEVICE.SHX** file was created after generating the tables of this D20MX device created. This file can be found within the device directory in windows explorer.



The **D20MXDEVICE.SHX** file is the file downloaded into the D20MX during the configuration download process.

Downloading a D20MX configuration

A D20MX configuration can be downloaded either through a:

- Local [Serial] Transfer of Configuration, or a
- Remote [Secure] Transfer of Configuration

Local [serial] transfer of configuration

The local transfer of configuration can be done by either:

- "Option 1 - use ConfigPro terminal emulator and the F7 key" on page 163
- "Option 2 - Use a non-ConfigPro terminal emulator and a "dl" command" on page 166

Option 1 - use ConfigPro terminal emulator and the F7 key

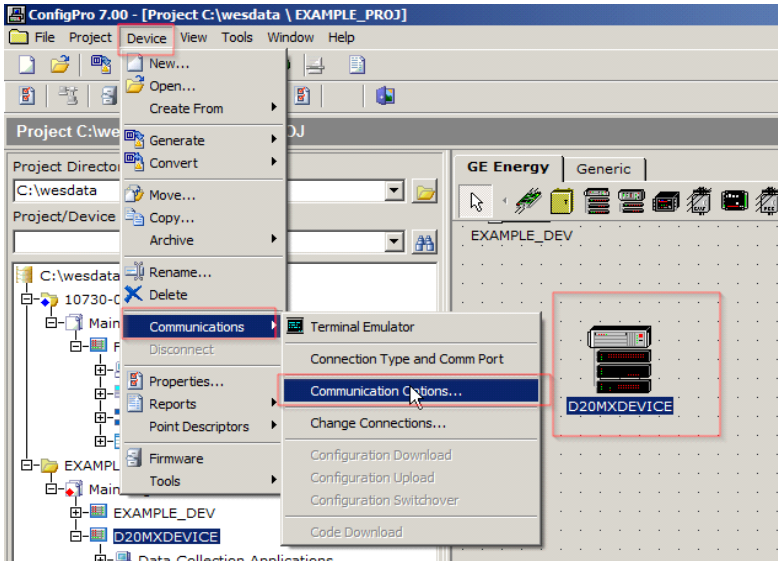
Serial configuration download to the D20MX is done from within ConfigPro similar to a D20.

To use a serial connection to download a configuration to the D20MX, using the ConfigPro terminal emulator and F7 key:

1. Connect a cable; either a:
   - NULL modem cable (GE Energy part number 977-0529) from the RS-232 connector at the front panel of the D20MX to the serial communication port of the PC.

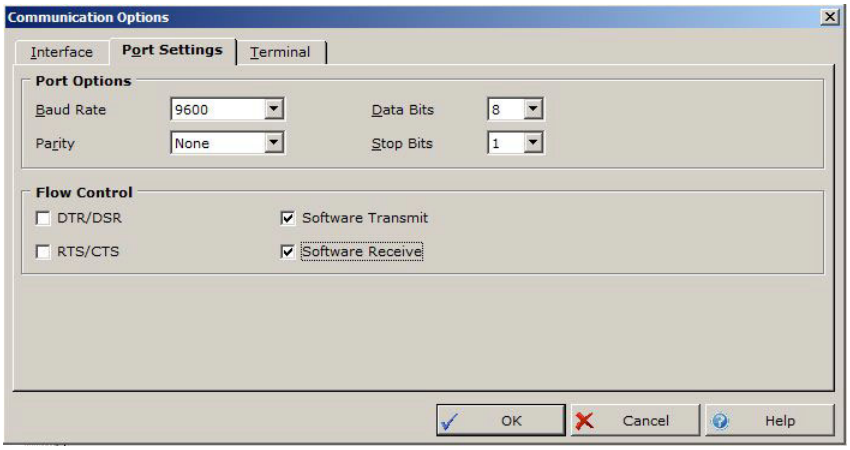
     OR
   - Wesmaint cable [977-0300] could be used to connect the Wesmaint port at the back of the D20MX chassis to the serial communication port of the PC.
2. Set up the terminal emulator with the D20MX communications parameters.
   2.1. From ConfigPro, select **Device** > **Communications** > **Communications Options...**.

   Result: The Communications Options window appears.



2.2. Set the communication options:

- Baud Rate: baud rate of the D20MX (9600 or 19200 bps - see "RS-232" on page 63 if you need to change the baud rate).
- Parity: **None**
- Data Bits: **8**
- Stop Bits; **1**



2.3. Connect to the D20MX device.

2.3.1. Right-click or click the device icon.

2.3.2. Select **Device** > **Communications** > **Terminal Emulator**.

2.3.3. Login to the D20MX terminal using the login and password. When logging into the D20MX for the first time, use the default login and password [Login: **admin** | Password: **changeme**].

Result: The D20M prompt appears.

2.3.4. Confirm that access is allowed by pressing the **Enter** key a couple of times.

2.4. Download [sync] the configuration from ConfigPro to the D20MX by pressing the F7 key on the key board.

2.5. Optionally you can set up the terminal emulator for faster download speed:

2.5.1. Login to the D20MX device through the ConfigPro Terminal Emulator.

Result: The D20M prompt appears.

2.5.2. Type **baud 57600** and press **Enter**.

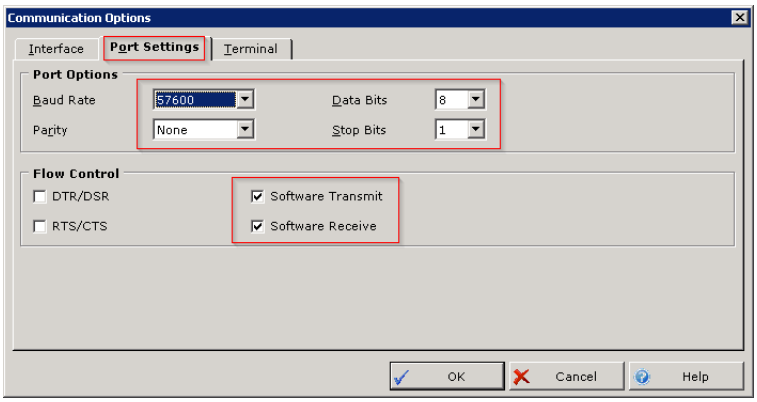
Result: The D20MX baud rate changes to 57600.

2.5.3. Disconnect the D20MX from ConfigPro by selecting **Communications** > **Disconnect**.

2.5.4. Open the communication properties by selecting **Device** > **Communications** > **Communications Options....**

Result: The Communications Options window appears.

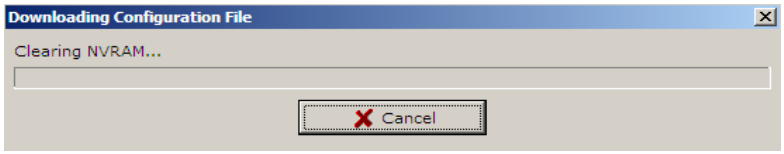
2.5.5. Change the baud rate to match 57600 by selecting the **Software Transmit** and **Software Receive** options and then clicking **OK**.



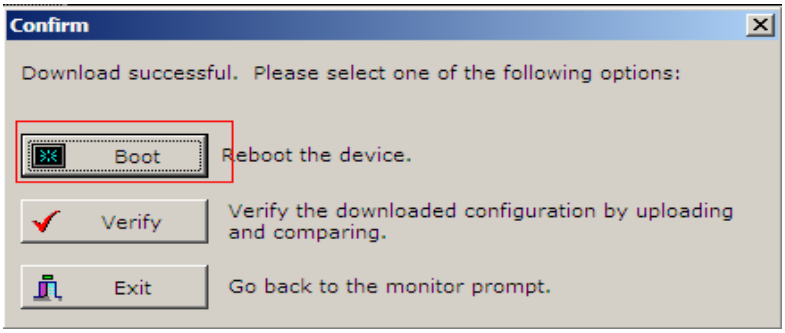
2.5.6. Reconnect to and login to the D20MX. See step 2.3 [Connect to the D20MX device].

2.5.7. Download [sync] the configuration from ConfigPro to the D20MX by pressing the **F7** key.

Result: The Download Configuration File progress bar appears.



2.6. Restart the D20MX device when the download is complete by clicking **Boot**.



NOTE

Booting the D20MX resets it to its previous baud rate. If the baud rate in the D20MX is not the same as that in the communication properties, the command prompt shows the following characters.

If this is the case, change the ConfigPro communication properties to match the baud rate of the D20MX.

Option 2 - Use a non-ConfigPro terminal emulator and a "dl" command

A **D20MXDEVICE.SHX** file is created when the tables of the D20MX device are generated. See section "Configuration file in project directory" on page 162 or see step 8 [Locate the **D20MXDEVICE.SHX** file] within this section.

Serially transfer the **D20MXDEVICE**.SHX file using Tera term (a terminal emulator) to the D20MX RTU using the dl command; this is similar to the download process of a D20ME firmware configuration. This download process is done at the D20M prompt.

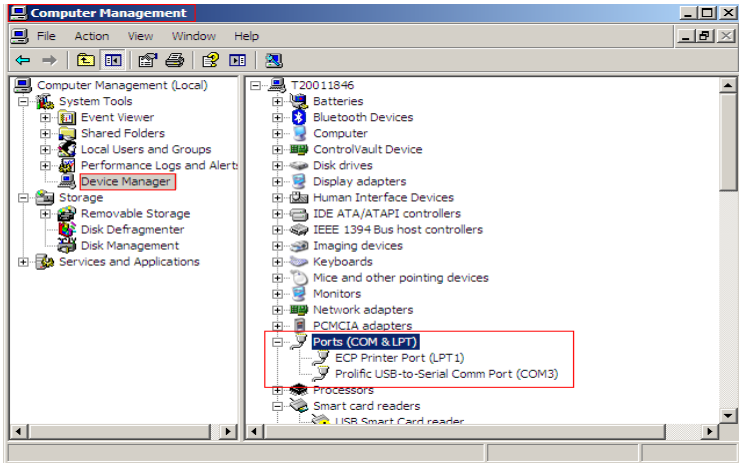
To download a configuration to the D20MX, using a non-ConfigPro terminal emulator and a "dl" command:

1. Connect a NULL modem cable (GE Energy part number 977-0529) from the RS-232 connector located at the front panel of the D20MX to the serial communications port of the PC or terminal.
2. Set-up a VT100 terminal emulator [e.g., Tera term Pro] with the following serial communication parameter values:

Parameter	Value
Port	COM1 or COM2, or as required by the computer being used.
Baud Rate	Baud rate of the D20MX (9600 or 19200 bps - see "RS-232" on page 63 if you need to change the baud rate).
Data	8 bit
Parity	none
Stop	1 bit
Flow Control	Xon/Xoff
Transmit delay	0 msec/char; 0 msec/line

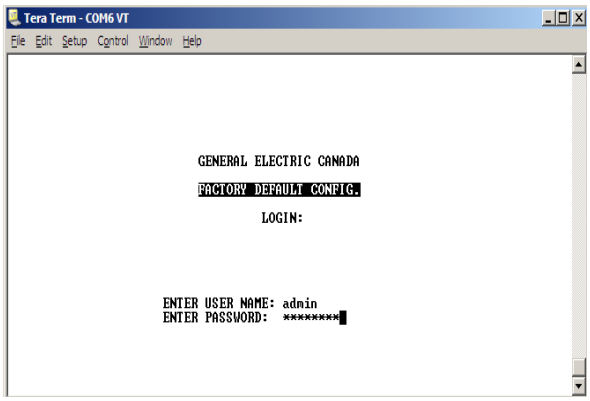
NOTE

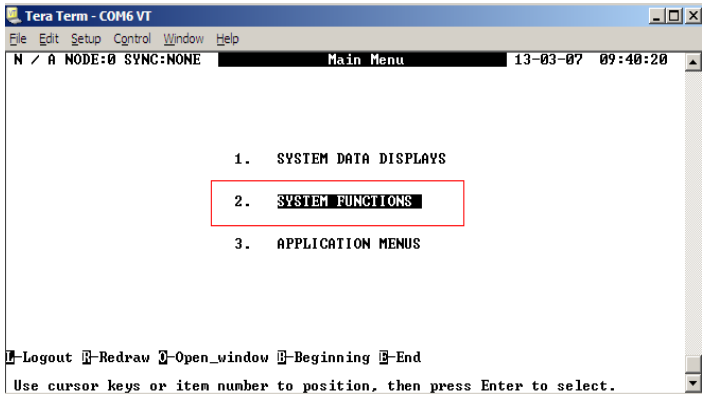
To determine the computer port used, on the computer's desk top, right-click on the **My Computer** short-cut icon and go to **Manage**. Go to **Device Manager** > **Ports** as shown below.

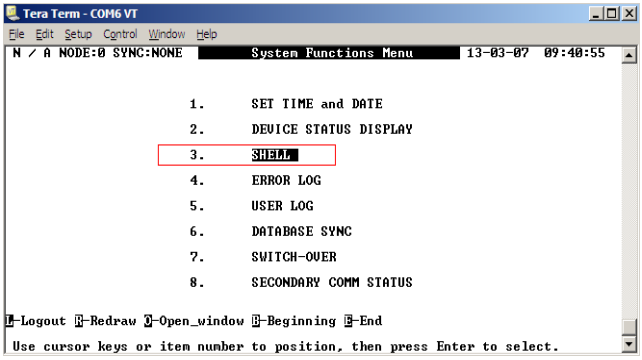


3. Login to the D20MX device. The factory default configuration for the D20MX comes with one default user account with: Username: **admin**; Password: **changeme**.

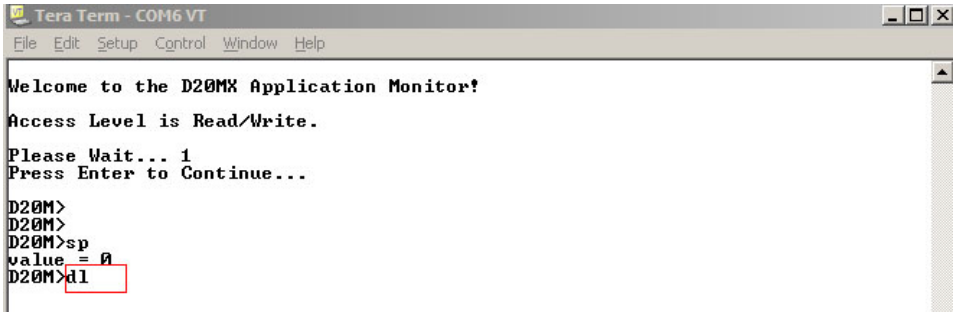
4. Navigate to the D20M prompt; this is called a SHELL prompt - an equivalent of the 68K monitor prompt.





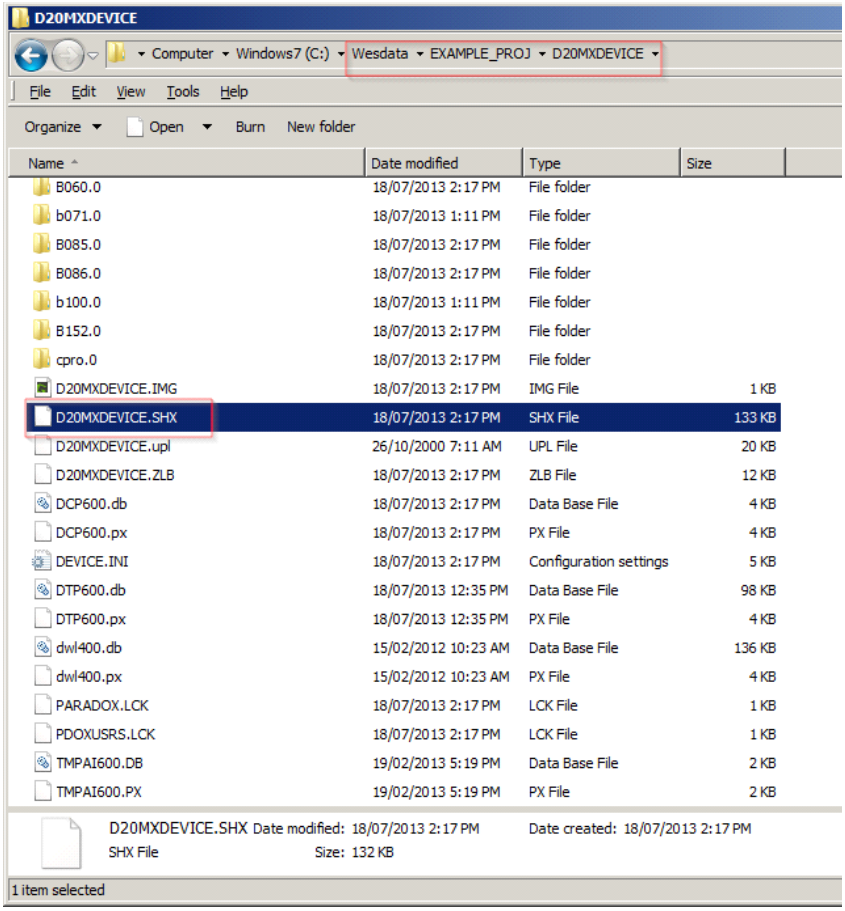


5. Press the **Enter** key a couple of time to display and confirm the required prompt; that is, D20M.

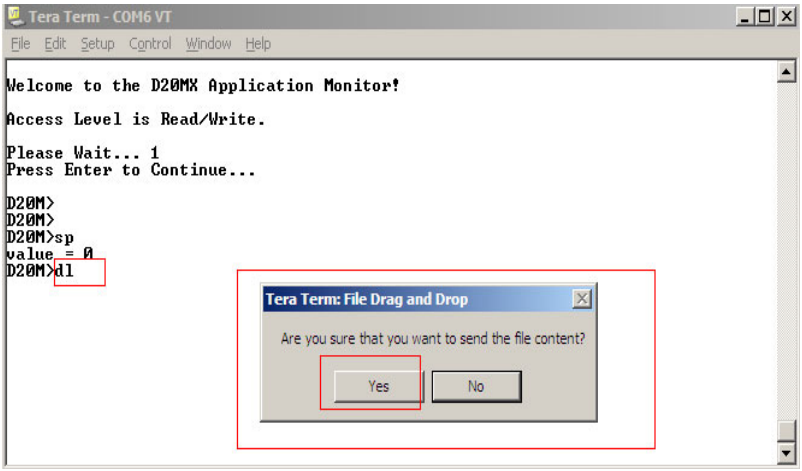


6. Type **sp** to suspend the processor, then type **dl** to download and press **Enter**.
7. The **D20MXDEVICE.SHX** file located in the project directory below can simply be dragged and dropped in the Tera term window.

8. Locate the **D20MXDEVICE.SHX** file.
   8.1. Open Windows explorer.
   8.2. Navigate to the project directory where this D20MX device is located.
   Note: The file name D20MXDEVICE represents the device name.



9. Drag and drop the **D20MXDEVICE.SHX** file onto the Tera term window.



NOTE

Once a configuration download has been completed, it is recommended that the default user account information be changed as soon as possible. Refer to the B014-1NCG WESMAINT II+ for the D20MX - Configuration Guide for details on how to modify user

accounts and how to change the password of a user. The D20MX configuration can be defaulted by pressing CTRL-F on a terminal connected over the front RS232 port during startup. In addition, if the D20MX detects a corrupt configuration on startup, it generates a system default configuration.

The system default configuration comes with one user account: username: **recover**; password: **system**. Login with this username and synchronize a configuration to the D20MX over the front RS232 port.

NOTE

The D20MX can only be accessed over the front RS232 port with the system default configuration.

If you synchronize a configuration with any of the following errors: "there are no usernames configured in the B014 User table"; "the B014 User table is disabled", or "the B014 application definition does not match the firmware version", then the applications do not start and you have only serial access in **debug mode**.

Remote [secure] transfer of configuration

Since Telnet and TFTP file transfer do not provide a secure means to connect or transfer data to the D20MX RTU, they are not supported within the D20MX.

The D20MX now supports both SSH and SFTP means of connection. The D20MX RTU must be equipped with a valid IP configuration that allows computer PC connectivity.

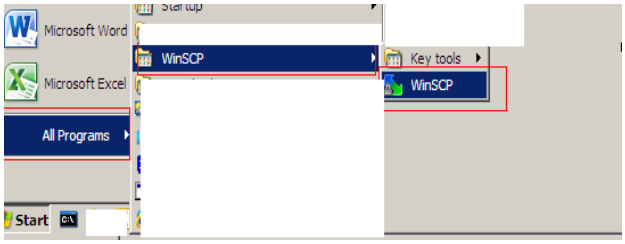
WinSCP is an example of a commonly used tool that allows connectivity to the D20MX remotely. This can be found on the web. WinSCP downloads are available at:

http://winscp.net/eng/download.php

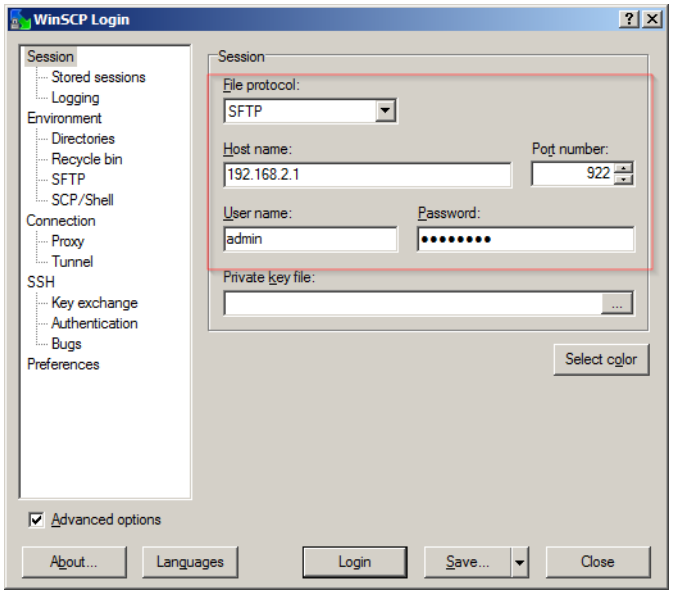
To transfer the configuration file:

1. Set your computer IP address to be in the same domain [IP address and Subnet mask] as the D20MX.
2. Close any currently opened terminal session to the D20MX.
3. Start **WinSCP**.

   Result: The WinSCP Login window appears.

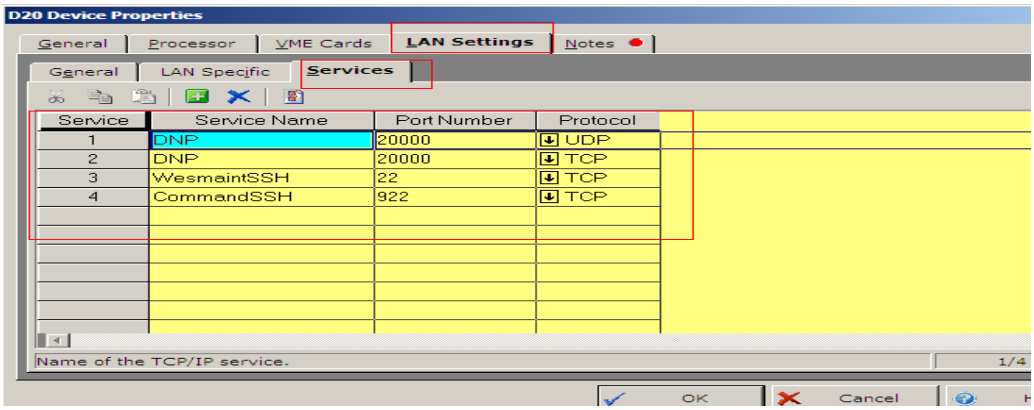


4. Login to WinSCP using the D20MX IP address and port number 922 or the configured CommandSSH port.

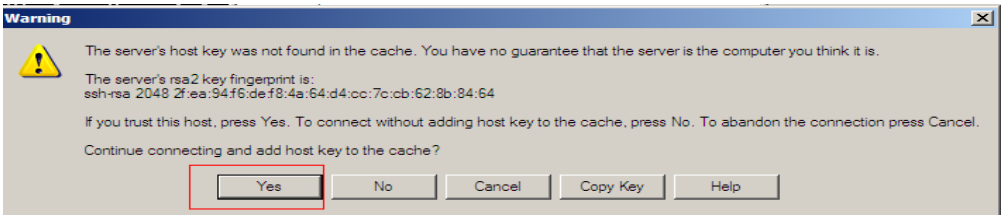


NOTE

In the D20MX configuration, port 922 has been created in the Services section of the Device LAN Properties as CommandSSH.



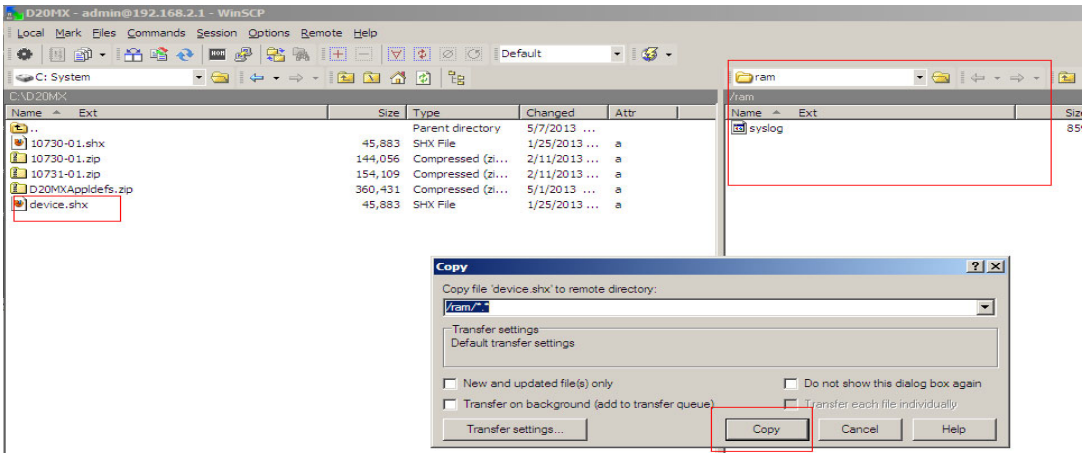
5. If the following window appears, click **Yes**.



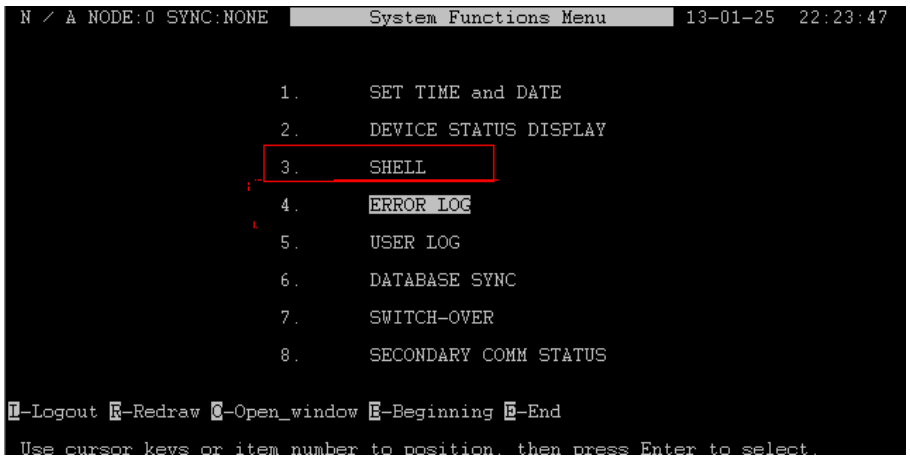
6. Make a copy of the generated configuration file **D20MXDEVICE.SHX** and rename it to **device.shx**.
7. Transfer the **device.shx** file by dragging it from your computer local drive into the D20MX's ram.

   Result: The Copy window appears.

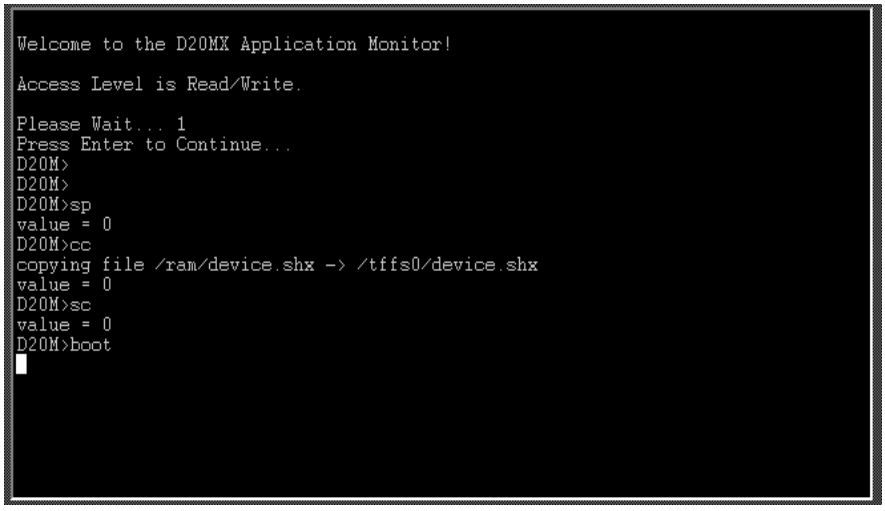
8. Click **Copy**.



9. Login to the D20M prompt of the D20MX RTU - this is the SHELL [option 3] menu.

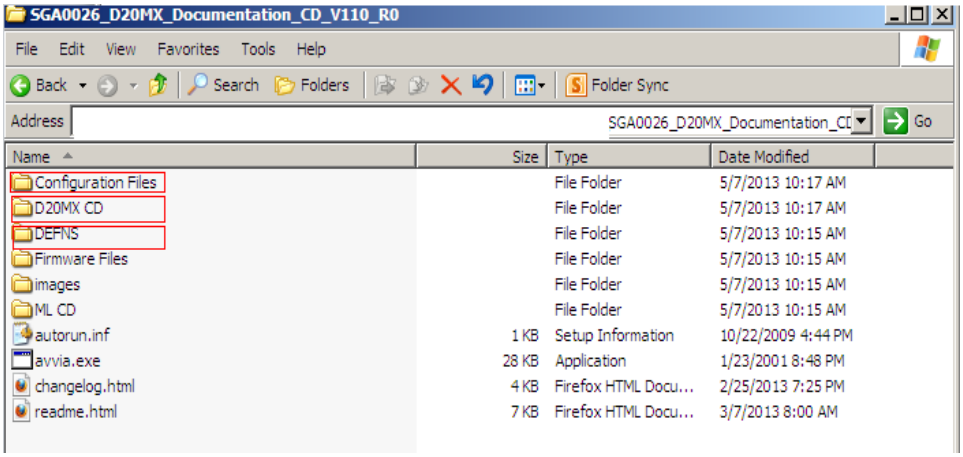


10. Suspend the processor by typing **sp** and pressing **Enter**.
11. Copy the configuration by typing **cc** and pressing **Enter**.
12. Select the configuration file by tying **sc** and pressing **Enter**.
13. Restart the D20MX device by typing **boot** and pressing **Enter**.



Application definition files and default configurations

The D20MX Documentation CD or extracted zip file contains numerous folders and files. The three main folders for the purpose of this document are highlighted below.



The D20MX Documentation CD or extracted zip file contains all of the following:

- Configuration guides, including the Wesmaint II+ user and configuration guides.
- Factory Default Configuration files: Application Definitions/D20MXv1_3Appldefs. The ConfigPro sub-folder contains the factory default zipped ConfigPro files.

Staging factory default configuration files

To stage the factory default configuration files so that they may be accessed by ConfigPro:

1. Press the Windows Key and **E** at the same time.

   Result: The Windows Explorer window appears.
2. Navigate to a folder to which you have write permissions.

   Result: The content of the folder appears.
3. Click the **New folder** button in Windows Explorer

   Result: A new folder is created with the name "New folder" and the cursor is positioned to allow renaming of the folder.
4. Rename the folder to **D20MXVXX**.

   Result: The folder is renamed to D20MXVXX.
5. Access the D20MX Documentation CD files by either:

   5.1. Insert the D20MX Documentation CD in to the computer's DVD/CD drive, or

   5.2. Extract the D20MX Documentation CD zip file on to the root of your C: drive and double click the **readme.html** file under the **ISO-Image** sub-folder, which is nested two levels deep into the extracted folder.

   Result: The Documentation CD home page appears in your default Web Browser.

   Result: Alternately for step 5.1, the home page does not appear in your default Web Browser. In this case, navigate to the CD in Windows Explorer, and double-click the **readme.html** file on the root of the CD.

6. Under the **D20MX Factory Default Configuration Files** section, click on the link named ConfigPro.

   Result: The Factory Default Configuration Files folder appears.

7. Using Windows Explorer, copy/paste the files as shown in the following table. To copy a file, select it and press **Ctrl-C**. To paste a file, click on the Windows Explorer window showing the new D20MXVXX folder and press **Ctrl-V**.

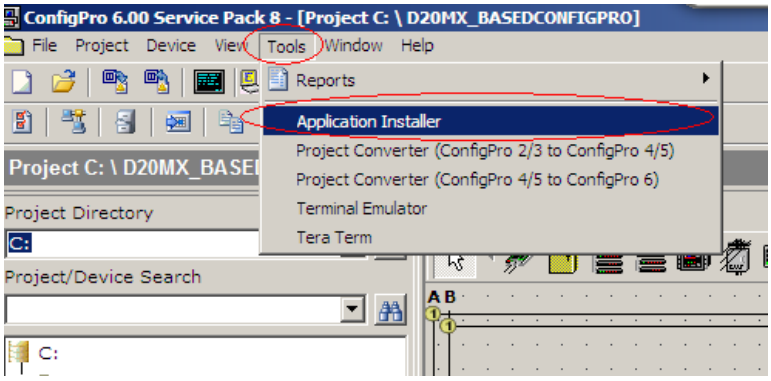
Navigate to folder on D20MX Documentation CD or Folder extracted from Zip File	Copy/Paste the following files to the new folder D20MXVXX
MX01-XX.zip	MX01-XX.zip
MX02-XX.zip	MX02-XX.zip

Result: The files shown in the above table appear in the new D20MXvXX folder of the Windows Explorer window.

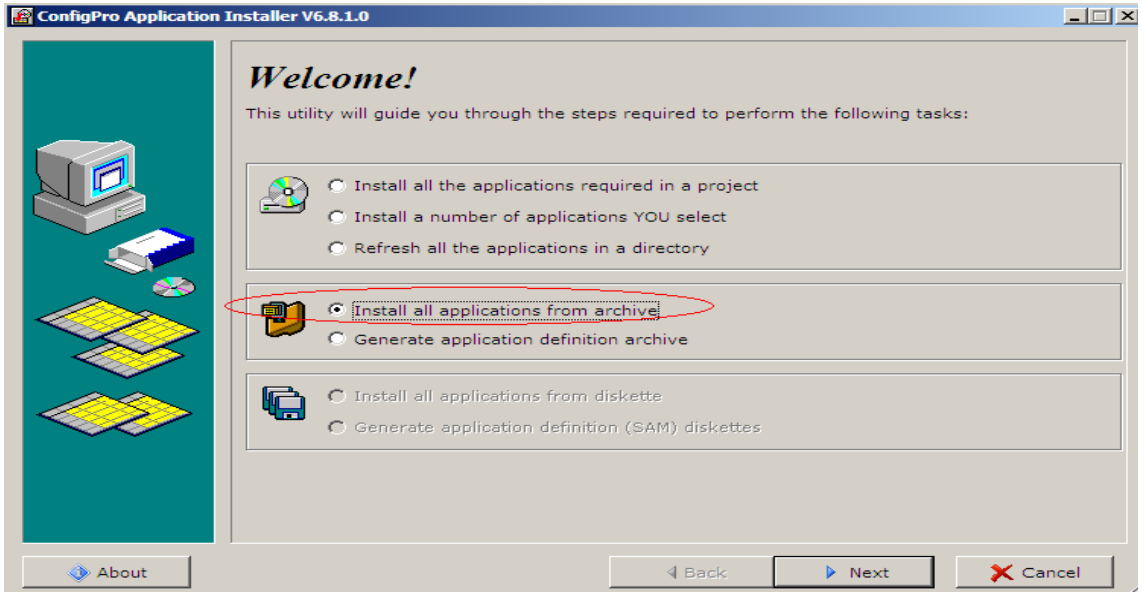
Installing application definitions: archived

To install the application definitions:

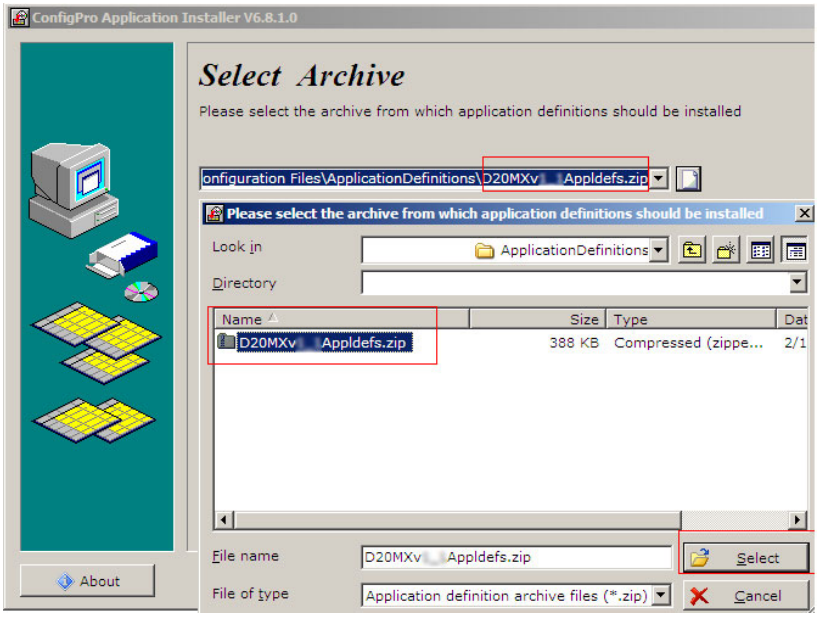
1. From ConfigPro, initiate the Application Installer by selecting **Tools** > **Application Installer**.



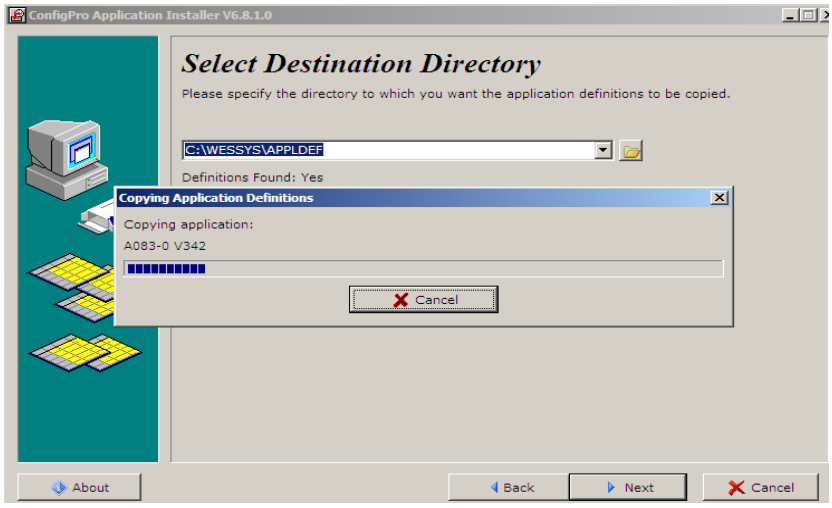
Result: The ConfigPro Application Installer - Welcome window appears.



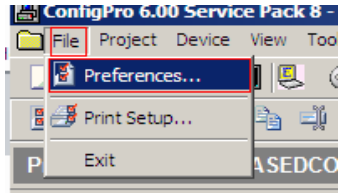
2. Select the **Install all applications from archive** option and click **Next**.
   Result: The ConfigPro Application Installer - Select Archive window appears.

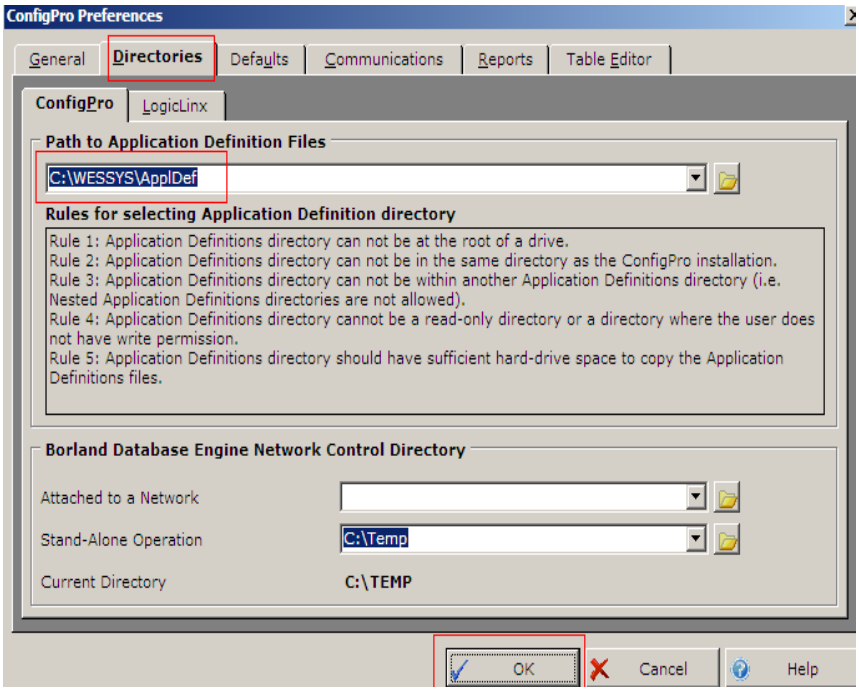


3. Select the source directory where the application archive is stored.
   3.1. Navigate to the source directory: Go to the D20MX Documentation CD or extracted zip file folder > **Configuration Files** sub-folder > **Application Definitions** folder.
   3.2. Select the **D20MXv1.5Appldefs.zip** file.
   3.3. Click **Select**.
4. Click **Next**.
   Result: The ConfigPro Application Installer - Select Destination Directory window appears.

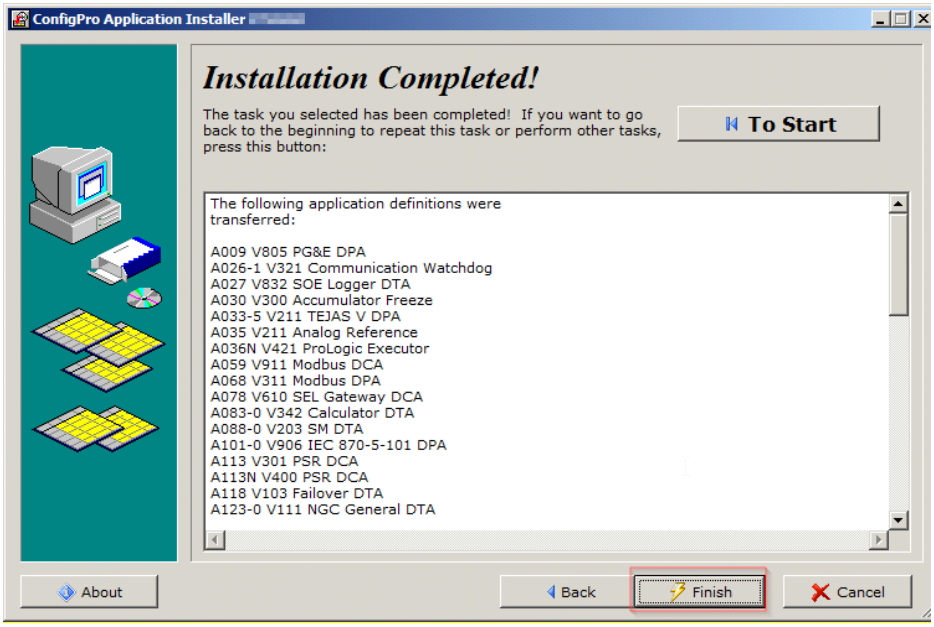


5. Select the destination directory into which the application definitions are to be copied. To determine the destination directory, in ConfigPro, go to **File** > **Preferences** > **Directories**. This is the path highlighted in the screen capture below [**C:\WESSYS\ApplDef**]





6. Click **Next**.
   Result: The ConfigPro Application Installer - Installation Complete window appears.



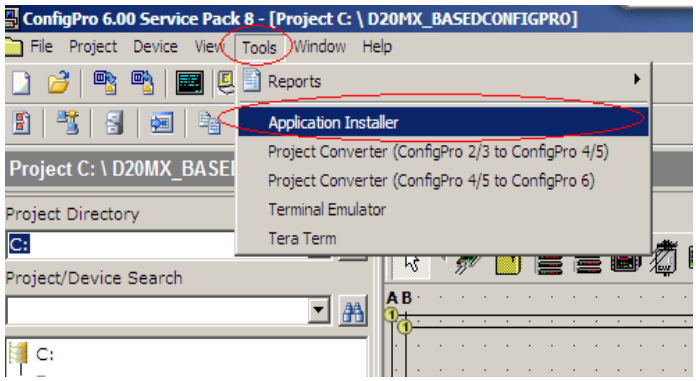
7. Click **Finish**.

Installing application definitions: non-archived

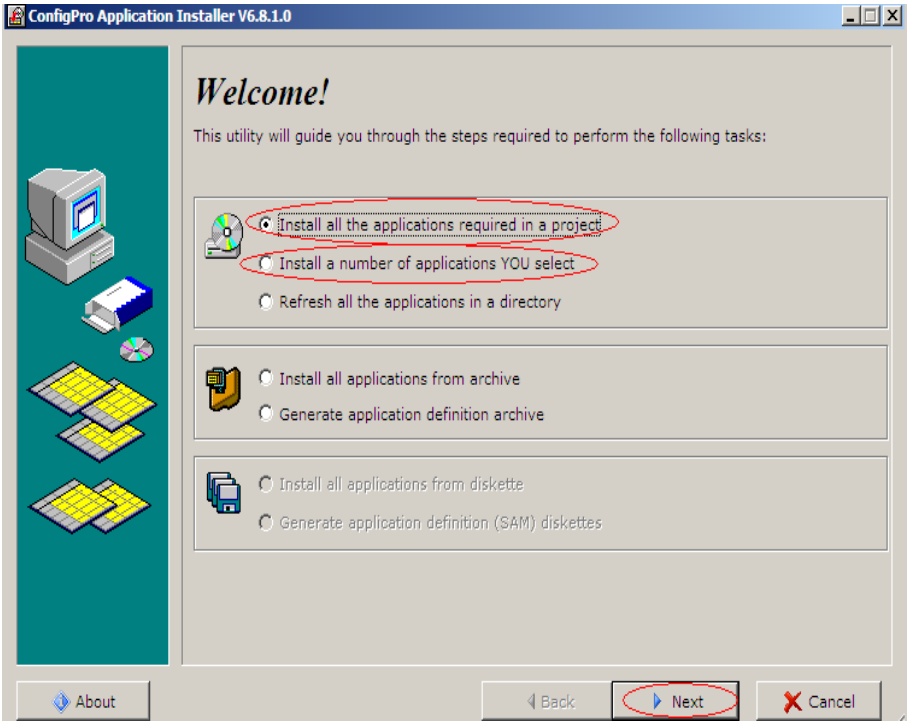
In the D20MX Documentation CD or extracted zip file, the **DEFNs** folder contains the **APPLDEF** sub-folder with all the application definition files.

To install missing application definition files:

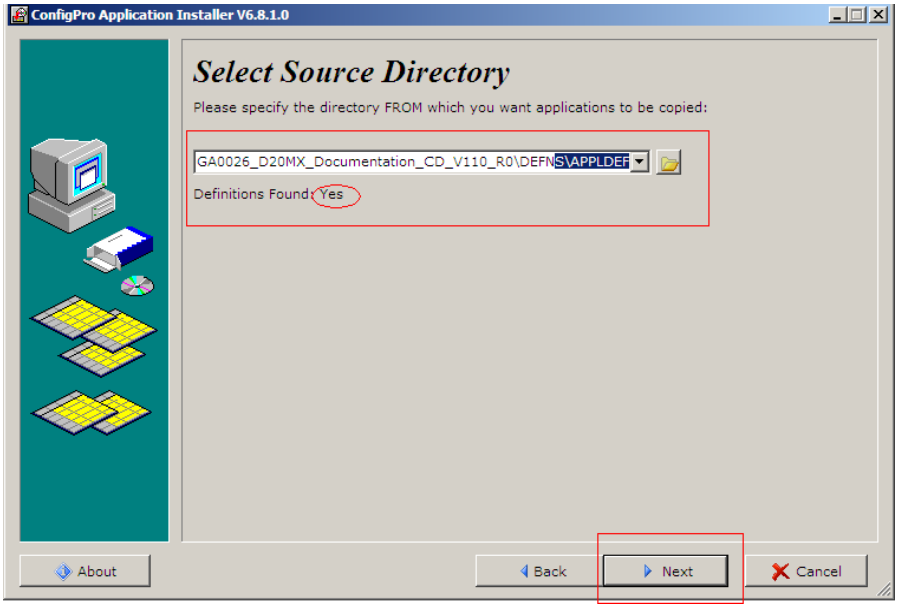
1. From ConfigPro select **Tools** > **Application Installer**.



Result: The ConfigPro Application Installer wizard appears.

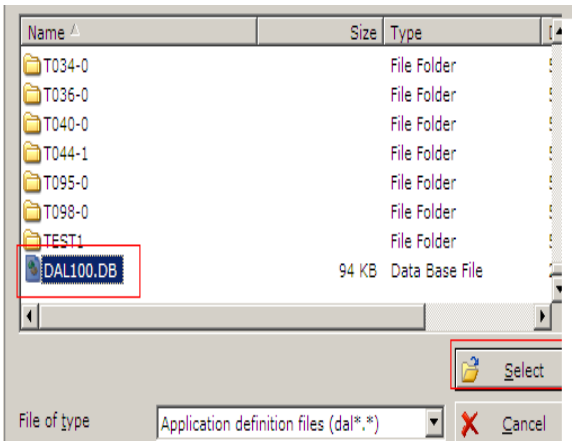


2. Choose either of the following options:
   - Install all the applications required in a project
   - Install a number of applications YOU select.
3. Click **Next**.
   Result: The ConfigPro Application Installer - Select Source Directory window appears.

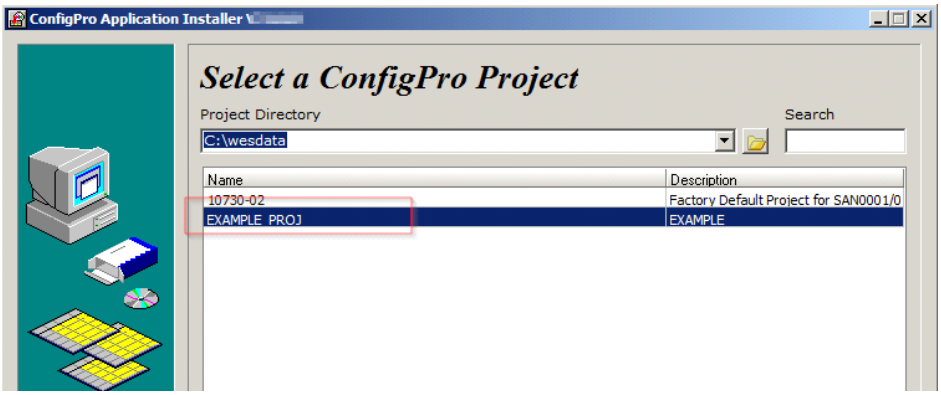


4. Select a Source director [this is the **DEFNs/ APPLDEF** path within the D20MX Documentation CD or extracted zip file].

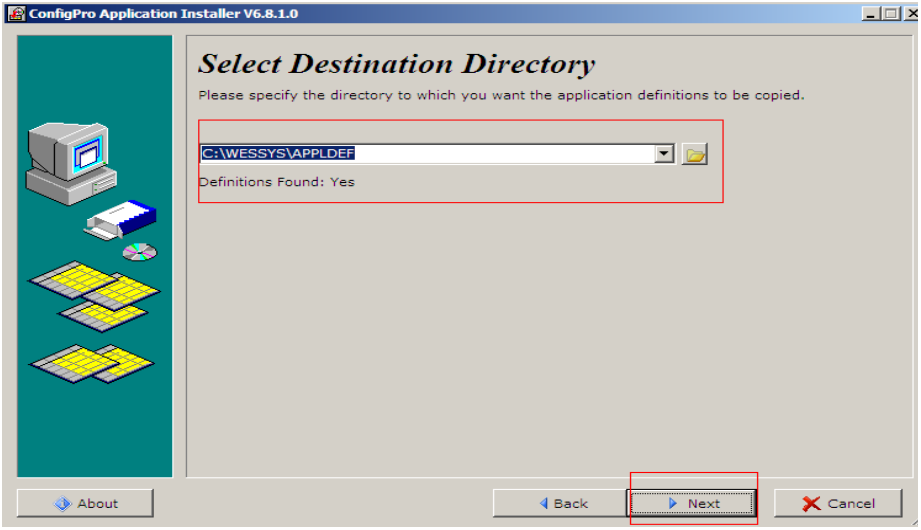
5. Select the **DAL100.DB** file and click **Select**. The Definitions Found field should indicate **Yes**.



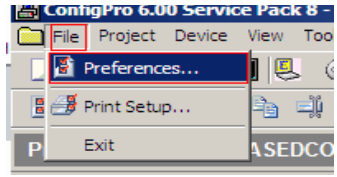
6. Click **Next**.
   Result: The ConfigPro Application Installer - Select a ConfigPro Project window appears.

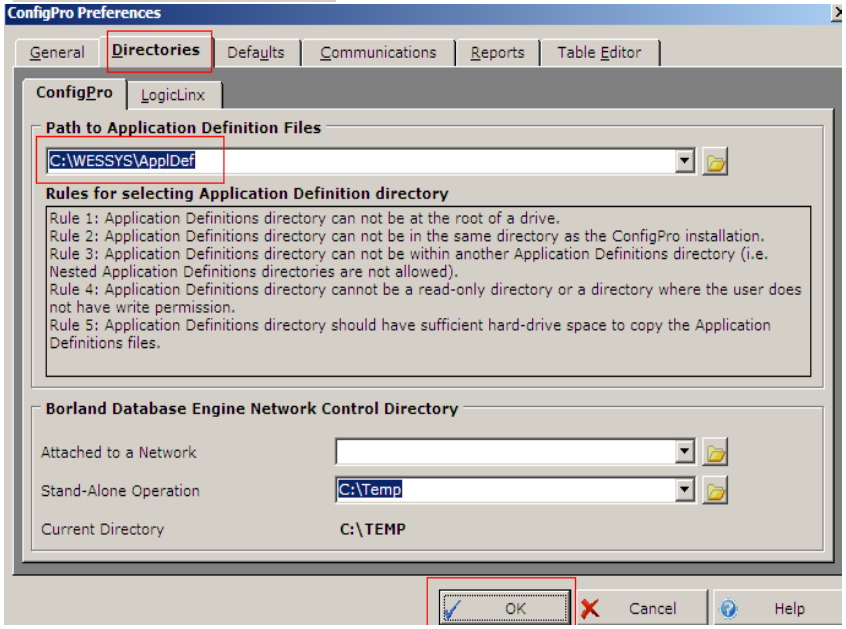


7. Select the ConfigPro project that requires these application definitions.
8. Click **Next**.
   Result: The ConfigPro Application Installer - Select Destination Directory window appears.

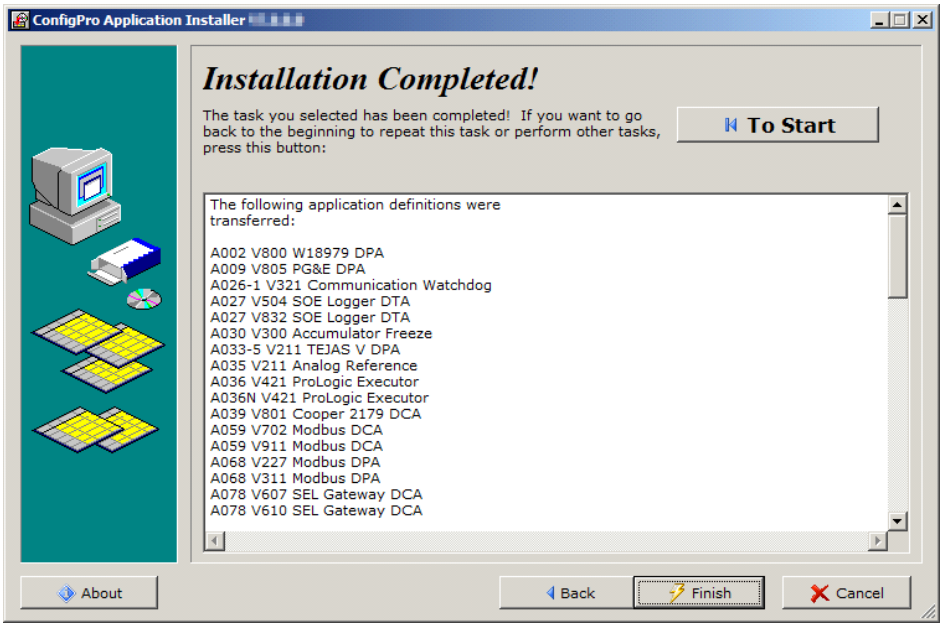


9. Select the destination directory into which the application definitions are to be copied.
   To determine the destination directory, in ConfigPro, go to **File** > **Preferences** > **Directories**. This is the path highlighted in the screen capture below [**C:\WESSYS\ApplDef**]





10. Click **Next**.
    Result: The ConfigPro Application Installer - Installation Complete window appears.



11. Click **Finish**.

D20MX Substation Controller

Appendix E: Secure Connection for LogicLinx

This appendix provides the procedure to set up a secure connection to the D20MX for use with the LogicLinx editor in either ConfigPro or SGConfig.

It is recommended that you use this procedure since it allows for strong security using the authentication, authorization and accounting model supported by other access points of the D20MX.

Secure connection with SGConfig v8.1 or higher

To set up a secure connection to the D20MX for use with the LogicLinx editor using SGConfig v8.1 or higher:

1. Configure B014-1N Wesmaint II+ to grant the necessary privileges to allow the user to make connections to the LogicLinx application on the D20MX.

   See “Wesmaint user configuration” on page 182.
2. Configure B082-0N LogicLinx to require a secure connection.

   See “LogicLinx (B082-0N) configuration” on page 184.
3. Establish the secure tunnel using the **LogicLinx Editor** > **LogicLinx Editor (Debug)** command in SGConfig. Refer to the SGConfig online help for details on the LogicLinx Editor.

Secure connection with ConfigPro

When using ConfigPro, the Windows* application 'PuTTY' (also known as “putty”) is used to establish an SSH tunnel from the LogicLinx editor running on the Windows PC to the LogicLinx application (B082) running on the D20MX. The establishment of an SSH Tunnel is also known as 'port forwarding'. At the time this procedure was published, the PuTTY Windows installer could be downloaded from:

http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

To set up a secure connection to the D20MX for use with the LogicLinx editor using ConfigPro:

1. Configure B014-1N Wesmaint II+ to grant the necessary privileges to allow the user to make connections to the LogicLinx application on the D20MX.

   Refer to section “Wesmaint user configuration” on page 182.
2. Configure B082-0N LogicLinx to require a secure connection.

   Refer to section: “LogicLinx (B082-0N) configuration” on page 184.
3. Establish the secure tunnel using PuTTY.

   Refer to section “PuTTY configuration” on page 185.
4. Configure the LogicLinx editor to use the secure tunnel.

   Refer to section “LogicLinx Editor configuration” on page 189.

Wesmaint user configuration

In this procedure, a new local user “tom” is created and granted privileges to make connections to the LogicLinx application on the D20MX. If you are using remote authentication with RADIUS, the required privileges are available in the default settings of the Administrator or Engineer role.

To grant the necessary privileges to allow a local user to make connections to the LogicLinx application on the D20MX:

1. View the Engineer role information from the RADIUS role table.

   In the Wesmaint II+ application:

   1.1. Open the RADIUS Role table.

   1.2. Select the row containing the role name “Engineer”.

   1.3. Scroll right until you see the “Application Control” column.

   1.4. Double click the **Application Control** field for the Engineer role.

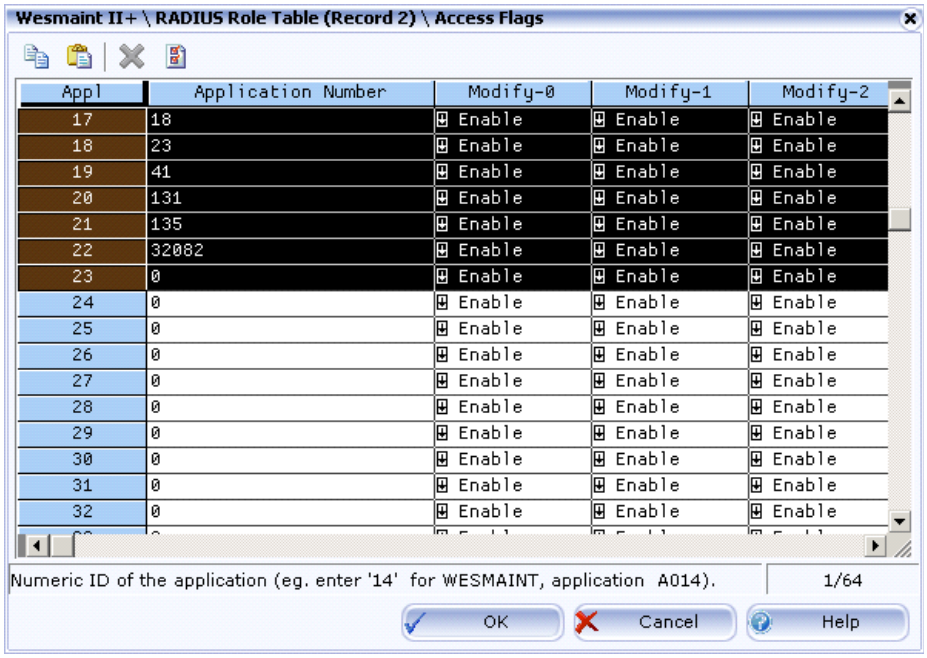
   Result: A dialog showing the access flags for the Engineer role appears.

2. Copy the access flags from the Engineer role:

   2.1. Select all of the rows up to the first row with a **0** in the **Application Control** field.

   2.2. Press **Ctrl-C** to copy the rows.

   Result: The access flags for the Engineer role as shown in the following screen are stored in the Windows clipboard.



3. View the access flags for a new local user:

   3.1. Open the User Configuration table.

   3.2. Add a new row and scroll left until you see the Application Control column.

   3.3. Double-click the **Application Control** field.

   Result: A dialog showing the access flags for the new user appears.

4. Select the first row and press **Ctrl-V** to paste the application control flags from the Engineer role to the new local user.

   Result: A dialog showing the Paste Options appears.

5. Click **OK**.

   Result: The access flags for the Engineer role now appear in the new user's access flag list.

6. Click **OK**.

   Result: The User Configuration table reappears.

7. For the Monitor Access Level field, select **Maintenance**.

8. For the User Name field, type the name of the user, for example: **tom**.

9. Click **OK** and **OK**.

   Result: The Wesmaint User Configuration is closed.

LogicLinx (B082-0N) configuration

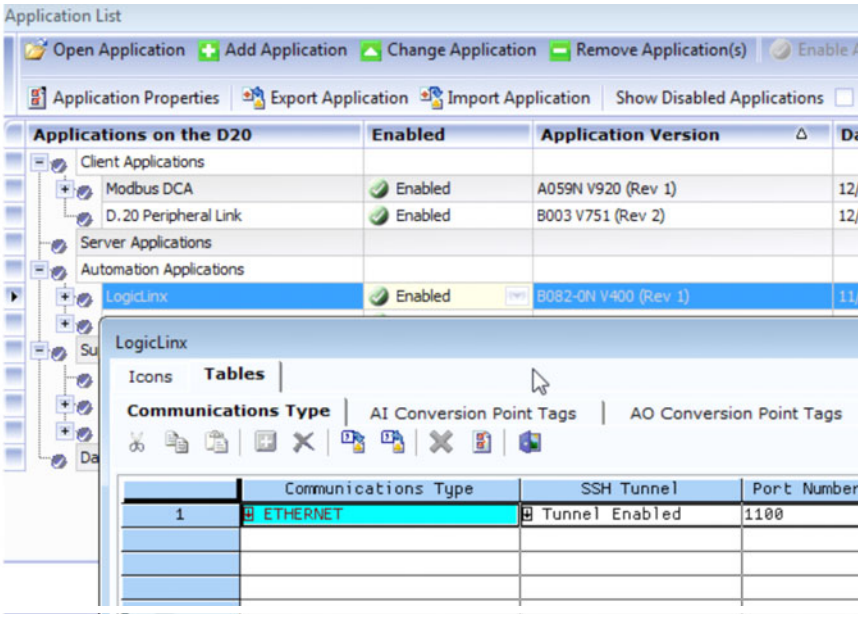
To configure B082-0N LogicLinx to require a secure connection:

1. In the Logic Linx (B082-0N V400) Communication Types configuration table set:
   a) Communications Type: Ethernet
   b) SSH Tunnel: Tunnel Enabled
   c) Port Number: 1100

NOTE

The Port Number may be any unused port number on the D20MX between 1 and 65535.

Result: The LogicLinx configuration appears as shown in the following screen.

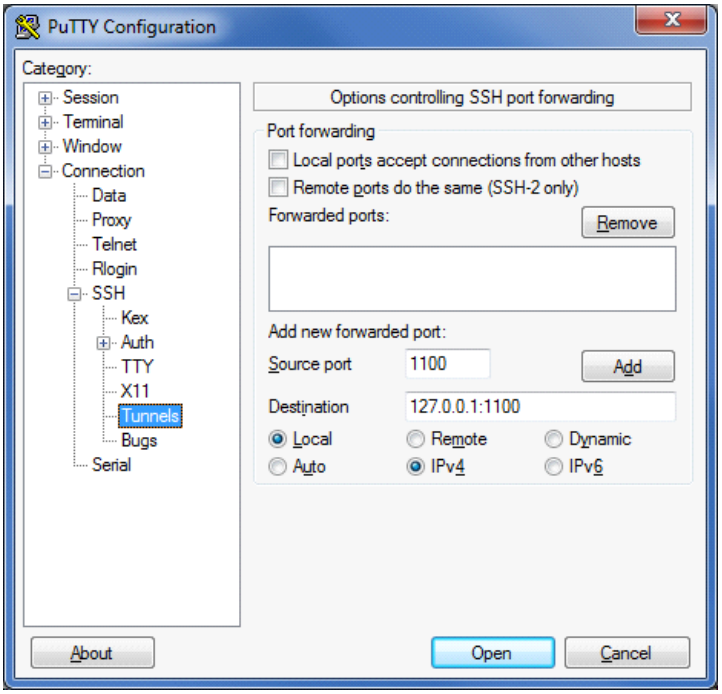


2. Generate and synchronize this configuration to the target D20MX.

PuTTY configuration

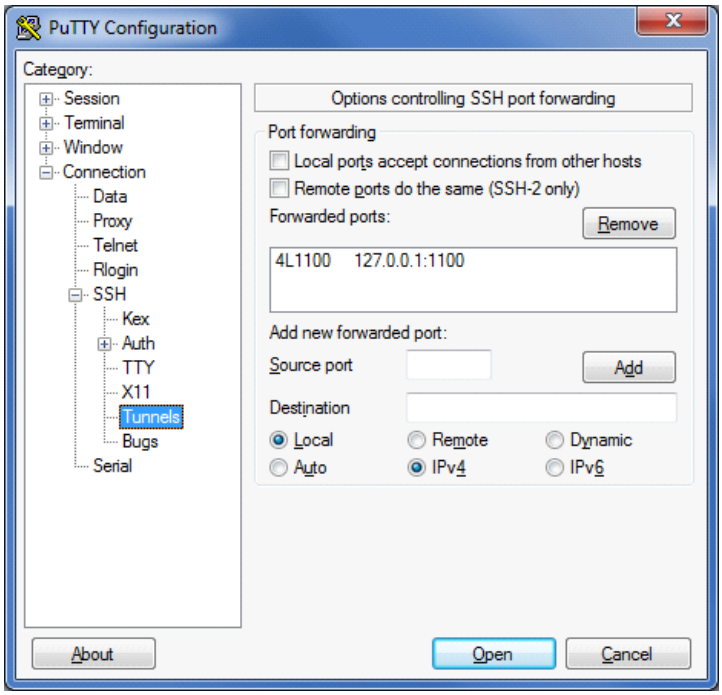
To establish a secure tunnel using PuTTY:

1. Start PuTTY.
2. In the PuTTY Configuration dialog box, select **Connection** > **SSH** > **Tunnels**.
   2.1. Under Port forwarding leave **Local ports ...** and **Remote ports...** unchecked.
   2.2. Under Add new forwarding port: in the Source Port box type **1100**, or any free TCP port number on your PC.
   2.3. In the **Destination** box, type the IP address **127.0.0.1:1100**, where 1100 is the port number set in the LogicLinx configuration (refer to step 1 in the: "LogicLinx (B082-0N) configuration" section).
   2.4. Click the **IPv4** radio button.
   Result: The PuTTY Configuration dialog box appears as in the following screen:



2.5. Click the **Add** button.

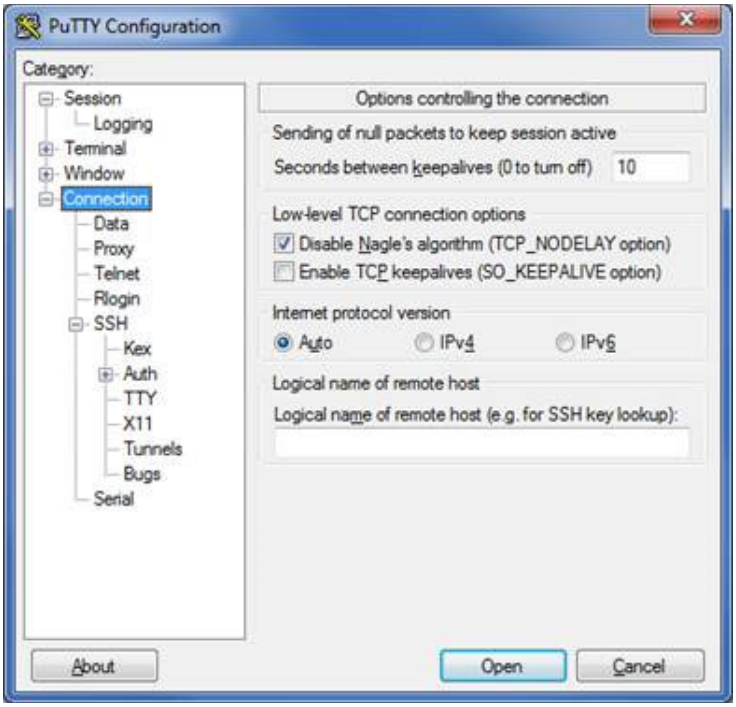
Result: The PuTTY Configuration dialog box appears as in the following screen:



3. In the PuTTY Configuration dialog box, select **Connection**.

3.1. In the **Seconds between keepalives ...** box, type **10**.

Result: The PuTTY Configuration dialog box appears as in the following screen:



4. In the PuTTY Configuration dialog box, select **Session**.

4.1. In the **Host Name** box type the address of the target D20MX, for example: 192.168.230.100.

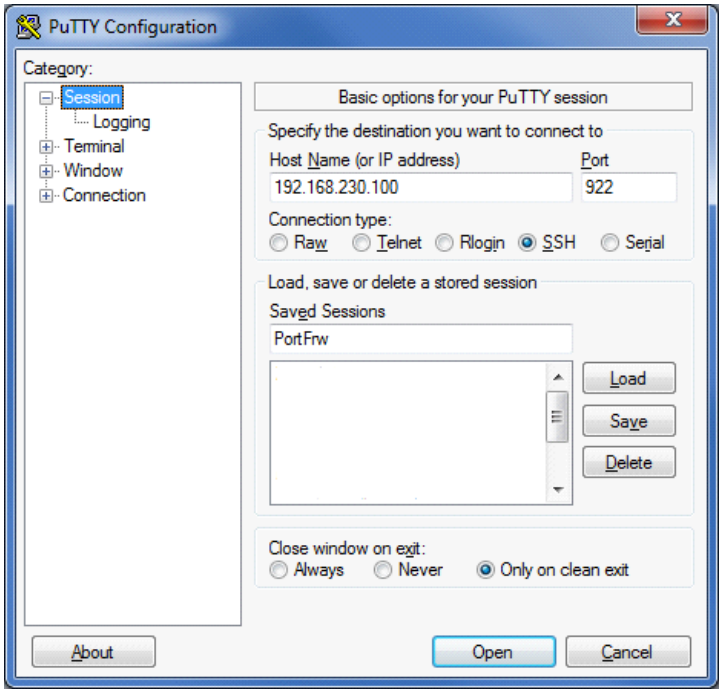
4.2. In the **Port** box type the configured commandSSH port number on the D20MX (for example, 922).

4.3. Under **Connection Type**, select **SSH**.

4.4. Type a name in the **Saved Sessions** box (for example, **PortFrw**) and click **Save**.

You may use the saved session the next time a secure connection is needed and avoid having to re-enter the PuTTY configuration settings.

Result: The PuTTY Configuration dialog box appears as in the following screen:

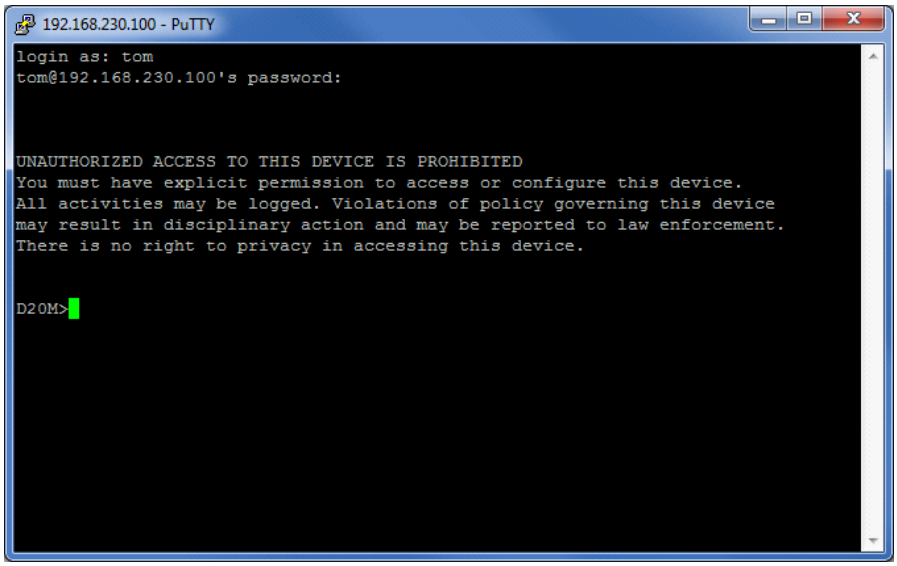


4.5. Click the **Open** button.

Result: A Terminal window appears.

5. Login as **tom**.

   Result: The Login Banner appears and the D20M> prompt appears as shown in the following screen:



NOTE

Leave the PuTTY window open throughout a debugger session or back-to-back debugger sessions. Once you are all finished running the debugger, close the PuTTY window to close down the SSH tunnel.

NOTE

When Tom logs in, a connection event is added to the User Log:. For example:

```
6 13/12/18 11:15:46 <Net OK > tom (SSH) -
originip="192.168.230.120" originMac="D8:9D:B9:00:0B:9C"
```

LogicLinx Editor configuration

To configure the LogicLinx editor to use the secure connection:

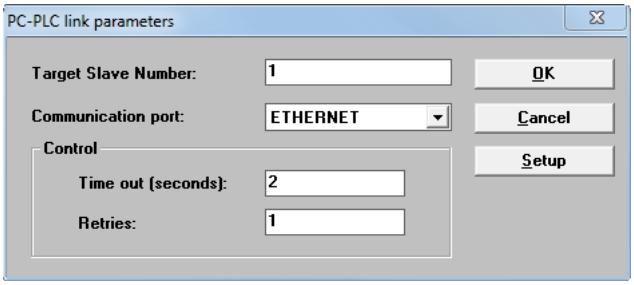
1. Start ConfigPro or SGConfig using "Run As Administrator".
2. Open the Project containing the target D20MX device.
3. If using ConfigPro, open the target D20MX device.
4. Start the LogicLinx editor:
   - 4.1. If using ConfigPro, right click on the **LogicLinx** icon under the **Data Translation Applications** tab and select **Tools** > **LogicLinx Editor**.
   - 4.2. If using SGConfig, click **LogicLinx** under the **Automation Applications** node of the Applications List, and then click the **LogicLinx Editor** icon.

     Result: The LogicLinx - Project Management window appears.
5. Double click the program icon or its name (e.g. main).

   Result: The LogicLinx Programs window appears.
6. Click the **Link Setup** icon.

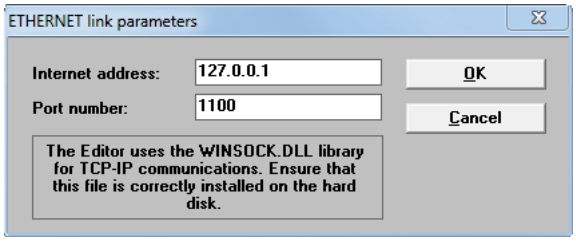
   Result: The PC-PLC link parameters dialog appears.
7. Set the **Communication port** box to **ETHERNET**.

   Result: The PC-PLC link parameters dialog appears as in the following screen:



8. Change the Ethernet link parameters:
   - 8.1. Click the **Setup** button.
   - 8.2. Type **127.0.0.1** into the **Internet address** box.
   - 8.3. Type the port number you entered in step 2.2.of section "PuTTY configuration" into the **Port number** box (for example: **1100**).

     Result: The ETHERNET link parameters dialog appears as shown in the following screen:



   - 8.4. Click **OK**.
9. Connect the debugger by clicking the **Debug** icon.

   Result: The LogicLinx Debugger window appears and is connected to the target D20MX.

NOTE

When Tom connects to the target D20MX, a port forward event is added to the User Log:. For example:

```
7 13/12/18 11:15:50 <SPF OK > tom (SSH) - Destination Port
FW:127.0.0.1:1100
```

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Appendix F: D20 Spare Cross-Reference

This appendix cross references the old part numbers with the new smart catalogue numbers. For the most part, the smart catalogue numbers represented here only indicate the prefix or base-line for the complete smart order code. For the complete smart order code, you need to specify the selections for the various sub-components.

Visit the online store for the appropriate spare parts and the rules governing sub-component selections:

- D20MX Processor spare parts
- D20K Control Output Module spare parts
- D20S Status Input Module spare parts
- D20A Analog Input Module spare parts
- D20C Combination I/O Module spare parts
- D20KI Interposer Relay Panel spare parts

This appendix provides spare cross-reference tables for the following modules:

D20 spare parts modules, spare cross-reference

Spare part numbers are listed for:

In the below tables > Smart Part Number Prefix column:

X-X represents Firmware and Bootrom Choice respectively
U-U represents "Not Needed"

Processors

Description	Part Number	Smart Catalog Number Prefix
D20MX CPU non VME 2x10/100/1000 BaseTX	526-3001	D20Mx-P-A-X-X
D20MX CPU non VME 2x100 BaseFX (Front Access)	526-3003	D20Mx-P-C-X-X
D20MX CPU non VME 2x100 BaseFX (Rear Access)	526-3005	D20Mx-P-G-X-X

Modems

Description	Part Number	Smart Catalog Number Prefix
WESDAC D20 202/V.23 Modem, bin mount	520-0120	D20ME-M-A-U-U
WESDAC D20 202/V.23 Modem, bin mount, conformal coated	520-0120-CC	D20ME-M-B-U-U
Modem, Telenetics 14.4K 2 wire Dialup, Bin mount	580-0771	D20ME-M-C-U-U
Modem, Telenetics 14.4K 4 wire Leased line, bin mount	580-0772	D20ME-M-D-U-U
WESDAC 202/V.23 Modem, 19 inch rack mount	520-0090	D20ME-M-E-U-U
WESDAC 202/V.23 Modem, 19 inch rack mount, conformal coated	520-0090-CC	D20ME-M-F-U-U

NOTE

The 520-0120, 520-0120-CC, 520-0090 and 520-0090-CC modems are currently not supported by the D20MX

Termination.

Description	Part Number	Smart Catalog Number Prefix
WESTERM D20 termination Panel, Panel Mount, 15 inch ribbon I/F cable	517-0225	D20ME-T-A-U-U
WESTERM D20 termination Panel, Panel Mount, 15 inch ribbon I/F cable, conformal coated	517-0225-CC	D20ME-T-D-U-U
WESTERM D20 termination Panel, Chassis Mount	517-0230	D20ME-T-B-U-U
WESTERM D20 termination Panel, Panel Mount, 24 inch ribbon I/F cable	517-0300	D20ME-T-C-U-U

Power supply

Description	Part Number	Smart Catalog Number Prefix
D20 Power Supply, 20-60VDC Input, 24V ISO Output	580-2004	D20ME-S-A-U-U
D20 Power Supply, 20-60VDC Input, 48V ISO Output	580-2005	D20ME-S-B-U-U
D20 Power Supply, 100-300VDC/85-264VAC Input, 24V ISO Output	580-2006	D20ME-S-C-U-U
D20 Power Supply, 100-300VDC/85-264VAC Input, 48V ISO Output	580-2007	D20ME-S-D-U-U

Chassis

Description	Part Number	Smart Catalog Number Prefix
D20 Chassis assembly non-VME 3U, single slot	500-0305	D20ME-C-A-U-U
D20 Chassis assembly VME 3U	500-0280 & Cover Plates	D20ME-C-B-U-U
D20 Chassis assembly non-VME 3U, single slot, Conformal Coated	500-0305-CC	D20ME-C-C-U-U
D20 Chassis assembly VME 3U, Conformal Coated	500-0280-CC & Cover Plates	D20ME-C-D-U-U

D20A analog input modules, spare cross-reference

Legacy and new part numbers are listed for:

D20A WESTERM modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
517-0163	WESTERM D20A Type 1 Version 1	D20A-TL-P-U	D20A 32 inputs, LV Power input (20-60VDC or D.20), compression termination
517-0163-CC	WESTERM D20A Type 1 Version 1 Conformal Coated	D20A-TL-P-C	D20A 32 inputs, LV Power input (20-60VDC or D.20), compression termination, conformal coated
517-0240	WESTERM D20 AZ	D20A-TH-P-U	D20AZ 32 inputs, HV Power input (40-150VDC), compression termination
517-0240-CC	WESTERM D20 AZ Conformal Coated	D20A-TH-P-C	D20AZ 32 inputs, HV Power input (40-150VDC), compression termination, conformal coated
517-0240-ECC	WESTERM D20 AZ - Epoxy Conformal Coated	D20A-TH-P-E	D20AZ 32 inputs, HV Power input (40-150VDC), compression termination, epoxy conformal coated
517-0328	WESTERM D20AB	D20A-TL-B-U	D20AB 32 inputs, LV Power input (20-60VDC or D.20), barrier termination
517-0328-CC	WESTERM D20AB Conformal Coated	D20A-TL-B-C	D20AB 32 inputs, LV Power input (20-60VDC or D.20), barrier termination, conformal coated
517-0178	WESTERM D20 AD	D20A-TL-D-U	D20AD 32 inputs, LV Power input (20-60VDC or D.20), DB25 termination
517-0178-CC	WESTERM D20 AD Conformal Coated	D20A-TL-D-C	D20AD 32 inputs, LV Power input (20-60VDC or D.20), DB25 termination, conformal coated
517-0251	WESTERM D20 OAD	D20A-TM-D-U	D20OAD 32 inputs, LV Power Input (40-150VDC), DB25 termination, redundant D.20 link and PS input
517-0216	WESTERM D20AX W/TB Plugs	D20A-TL-X-U	D20AX 32 inputs, LV Power input (20-60VDC or D.20), compression disconnect termination
517-0216-CC	WESTERM D20AX W/TB Plugs Conformal Coated	D20A-TL-X-C	D20AX 32 inputs, LV Power input (20-60VDC or D.20), compression disconnect termination, conformal coated
517-0364	WESTERM D20AZ Break Away W/ TBS	D20A-TH-X-U	D20AZ 32 inputs, HV Power input (40-150VDC), compression disconnect termination

D20A WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
511-0101	WESDAC D20A Type 1 Version 1	D20A-DL-U-U	WESDAC D20A LV
511-0101-CC	WESDAC D20A Type 1 Version 1 Conformal Coated	D20A-DL-U-C	WESDAC D20A LV Conformal Coated
511-0103	WESDAC D20A HV2	D20A-DH-U-U	WESDAC D20A HV
511-0103-CC	WESDAC D20A HV2 Conformal Coated	D20A-DH-U-C	WESDAC D20A HV Conformal Coated
511-0103-ECC	WESTERM D20SX W/TB Plugs	D20A-DH-U-E	WESDAC D20A HV Epoxy Conformal Coated

DNP3A WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
511-0301	DNP I/O Module - DC Analog Input	D20A-3L-U-U	WESDAC D20A LV, DNP3 Communications
511-0301	DNP I/O Module - DC Analog Input Conformal Coated	D20A-3L-U-C	WESDAC D20A LV, DNP3 Communications, Conformal Coated
511-0303	DNP I/O Module - DC Analog Input HV	D20A-3H-U-U	WESDAC D20A HV, DNP3 Communications

D20A adapter modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
530-0004	Analog Adaptor, I/P Voltage	D20A-U-U-U-U-U-1-U-U	Voltage Input adaptor - /+ 1, +/- 5, +/- 10 VDC (Set of 32: 530-0004)
530-0005	Analog Adaptor, I/P 1MA/1V	D20A-U-U-U-U-U-2-U-U	1 mA / 1V current input adaptor (Set of 32: 530-0005)
530-0045	Analog Adaptor, I/P 2MA/1V	D20A-U-U-U-U-U-3-U-U	10 mA / 5V current input adaptor (Set of 32: 530-0045)
530-0050	1MA/5V I/P Analog Adaptor	D20A-U-U-U-U-U-4-U-U	1 mA / 5V current input adaptor (Set of 32: 530-0050)
530-0025	1.2MA/1V I/P Analog Adaptor	D20A-U-U-U-U-U-5-U-U	1.2 mA / 1V current input adaptor (Set of 32: 530-0025)
530-0051	Analog Adaptor, I/P (2MA/5V)	D20A-U-U-U-U-U-6-U-U	2 mA / 5V current input adaptor (Set of 32: 530-0051)
530-0052	Analog Adaptor, I/P 20MA/5V	D20A-U-U-U-U-U-7-U-U	20 mA / 5V current input adaptor (Set of 32: 530-0052)
530-0090	Analog Adaptor, I/P 1MA/5V	D20A-U-U-U-U-U-9-U-U	1 mA / 5V current input adaptor, high precision (Set of 32: 530-0090)
530-0095	Analog Adaptor, I/P 1.5MA/5V	D20A-U-U-U-U-U-A-U-U	1.5 mA / 5V current input adaptor (Set of 32: 530-0095)
530-0108	Analog Adaptor, 2MA/5V I/P 0.01%	D20A-U-U-U-U-U-B-U-U	2 mA / 5V current input adaptor, high precision 0.01% (Set of 32: 530-0108)
530-0003	Analog Adaptor, I/P 20MA/1V	D20A-U-U-U-U-U-C-U-U	20mA/1V current input adaptor (Set of 32: 530-0003)
530-0030	1.5MA/1V I/P Analog Adaptor	D20A-U-U-U-U-U-D-U-U	1.5 mA / 1V current input adaptor (Set of 32: 530-0030)
530-0073	5MA/1V I/P Analog Adaptor	D20A-U-U-U-U-U-G-U-U	5mA/1V current input adaptor (Set of 32: 530-0073)
530-0085	2.5MA/5V I/P Analog Adaptor	)D20A-U-U-U-U-U-J-U-U	2.5mA/5V current input adaptor (Set of 32: 530-0085)
530-0091	1.1MA/5V I/P Analog Adaptor	D20A-U-U-U-U-U-N-U-U	1.1mA/5V current input adaptor (Set of 32: 530-0091)
530-0094	Analog Adaptor, I/P 1.25MA/5V	D20A-U-U-U-U-U-P-U-U	1.25mA/5V current input adaptor (Set of 32: 530-0094)
530-0131	Analog Adaptor 12.8MA/5V	D20A-U-U-U-U-U-Q-U-U	12.8mA/5V current input adaptor (Set of 32: 530-0131)
530-0086	50MA/5V I/P Analog Adaptor	D20A-U-U-U-U-U-H-U-U	50mA/5V current input adaptor (Set of 32: 530-0086)

D20C combination modules, spare cross-reference

Legacy and new part numbers are listed for:

D20C WESTERM Modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
517-0169	WESTERM D20C Type 1 Version 1	D20CS-T-1	D20C LV (20-60VDC or D.20 Power), Compression Termination & DB25 for Interposer relays
517-0180	WESTERM D20 CD	D20CS-T-2	D20CD LV (20-60VDC or D.20 Power), DB25 Termination
517-0326	WESTERM D20 CB	D20CS-T-3	D20CB LV (20-60VDC or D.20 Power), Barrier Termination & DB25 for Interposer relays
517-0217	WESTERM D20 CX W/TB Plugs	D20CS-T-4	D20CX LV (20-60VDC or D.20 Power), Compression Disconnect Termination & DB25 for Interposer relays
517-0333	WESTERM D20 CDI, 48V	D20CS-T-6	D20CDI LV (20-60VDC or D.20 Power), 48V Isolated Common & DB25 for Interposer relays
517-0263	WESTERM D20 CDI, 130V	D20CS-T-7	D20CDI LV (20-60VDC or D.20 Power), 130V Isolated Common & DB25 for Interposer relays (
517-0239	WESTERM D20 C4Z, 48V DI	D20CS-T-8	D20C4Z HV 48V DI Compression Termination Analog Input Only
517-0325	WESTERM D20 C4Z2, 48V DI	D20CS-T-5	D20C4Z HV 48V DI Compression Disconnect Termination
517-0253	WESTERM D20 C4Z 110V DI	D20CS-T-9	D20C4Z HV 110V DI Compression Termination Analog Input Only
517-0362	WESTERM D20 C4Z2 24V DI	D20CS-T-A	D20C4Z2 HV 24V DI Compression Termination Analog Input & Output Allowed
517-0363	WESTERM D20 C4Z2 with Plugs, 48V DI	D20CS-T-C	D20C4Z2 HV 48V DI Compression Disconnect Termination
517-0267	WESTERM D20 C4Z2 (220V)	D20CS-T-D	D20C4Z2 HV 220V DI Compression Disconnect Termination

D20C WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
504-0002	WESDAC D20C+	D20CS-D-1	WESDAC D20C LV
504-0003	WESDAC D20C HV	D20CS-D-2	WESDAC D20C HV

DNP3C WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
504-0302	DNP I/O LV Module - Combination	D20CS-3-1	WESDAC D20C LV, DNP3 Communications
504-0303	DNP I/O HV Module - Combination	D20CS-3-2	WESDAC D20C HV, DNP3 Communications

D20C digital input adapter modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
245-0031	D20 C 12V Digital Input Adapter	D20CS-U-U-U-1-U-U-U-U-U-U-U	12V Digital Input Adapter [245-0031]
245-0030 (4x), 245-0029 (2x)	D20 C 24V Digital Input Adapter	D20CS-U-U-U-2-U-U-U-U-U-U-U	24V Digital Input Adapter [245-0030 (4x), 245-0029 (2x)]
245-0004	D20 C 48V Digital Input Adapter	D20CS-U-U-U-3-U-U-U-U-U-U-U	48V Digital Input Adapter [245-0004]
530-0133	D20 C 130V Digital Input Adapter for LV	D20CS-U-U-U-4-U-U-U-U-U-U-U	130V Digital Input Adapter for LV [530-0133]
245-0012	D20 C 220V Digital Input Adapter for HV	D20CS-U-U-U-5-U-U-U-U-U-U-U	130V Digital Input Adapter for HV [245-0012]

D20C first slot of analog adapter modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
530-0004	D20C Voltage Input Adapter	D20CS-U-U-U-U-1-U-U-U-U-U	Voltage Input Adapter [530-0004]
530-0087	0.1mA to 5V Current Input Adapter	D20CS-U-U-U-U-2-U-U-U-U-U	0.1mA to 5V Current Input Adapter [530-0087]
530-0088	0.3mA to 5V Current Input Adapter	D20CS-U-U-U-U-3-U-U-U-U-U	0.3mA to 5V Current Input Adapter [530-0088]
530-0089	0.5mA to 5V Current Input Adapter	D20CS-U-U-U-U-4-U-U-U-U-U	0.5mA to 5V Current Input Adapter [530-0089]
530-0050	1 mA to 5V Current Input Adapter	D20CS-U-U-U-U-5-U-U-U-U-U	1 mA to 5V Current Input Adapter [530-0050]
530-0090	1 mA to 5V Current Input Adapter [High Precision]	D20CS-U-U-U-U-6-U-U-U-U-U	1 mA to 5V Current Input Adapter [High Precision] [530-0090]
530-0091	1.1 mA to 5V Current Input Adapter	D20CS-U-U-U-U-7-U-U-U-U-U	1.1 mA to 5V Current Input Adapter [530-0091]
530-0094	1.25 mA to 5V Current Input Adapter	D20CS-U-U-U-U-8-U-U-U-U-U	1.25 mA to 5V Current Input Adapter [530-0094]
530-0095	1.5 mA to 5V Current Input Adapter	D20CS-U-U-U-U-9-U-U-U-U-U	1.5 mA to 5V Current Input Adapter [530-0095]
530-0051	2 mA to 5V Current Input Adapter	D20CS-U-U-U-U-A-U-U-U-U-U	2 mA to 5V Current Input Adapter [530-0051]
530-0108	2 mA to 5V Current Input Adapter [High Precision]	D20CS-U-U-U-U-B-U-U-U-U-U	2 mA to 5V Current Input Adapter [High Precision] [530-0108]
530-0086	2.5 mA to 5V Current Input Adapter	D20CS-U-U-U-U-C-U-U-U-U-U	2.5 mA to 5V Current Input Adapter [530-0085]
530-0045	2mA to 1V Current Input Adapter	D20CS-U-U-U-U-D-U-U-U-U-U	2mA to 1V Current Input Adapter [530-0045]
530-0131	12.8 mA to 5V Current Input Adapter	D20CS-U-U-U-U-E-U-U-U-U-U	12.8 mA to 5V Current Input Adapter [530-0131]
530-0052	20 mA to 5V Current Input Adapter	D20CS-U-U-U-U-F-U-U-U-U-U	20 mA to 5V Current Input Adapter [530-0052]
530-0086	50 mA to 5V Current Input Adapter	D20CS-U-U-U-U-G-U-U-U-U-U	50 mA to 5V Current Input Adapter [530-0086]

D20C second slot of analog adapter modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
530-0004	D20C Voltage Input Adapter	D20CS-U-U-U-U-U-1-U-U-U-U	Voltage Input Adapter [530-0004
530-0087	0.1mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-2-U-U-U-U	0.1mA to 5V Current Input Adapter [530-0087]
530-0088	0.3mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-3-U-U-U-U	0.3mA to 5V Current Input Adapter [530-0088]
530-0089	0.5mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-4-U-U-U-U	0.5mA to 5V Current Input Adapter [530-0089]
530-0050	1 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-5-U-U-U-U	1 mA to 5V Current Input Adapter [530-0050]
530-0090	1 mA to 5V Current Input Adapter [High Precision]	D20CS-U-U-U-U-U-6-U-U-U-U	1 mA to 5V Current Input Adapter [High Precision] [530-0090]
530-0091	1.1 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-7-U-U-U-U	1.1 mA to 5V Current Input Adapter [530-0091]
530-0094	1.25 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-8-U-U-U-U	1.25 mA to 5V Current Input Adapter [530-0094]
530-0095	1.5 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-9-U-U-U-U	1.5 mA to 5V Current Input Adapter [530-0095]
530-0051	2 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-A-U-U-U-U	2 mA to 5V Current Input Adapter [530-0051]
530-0108	2 mA to 5V Current Input Adapter [High Precision]	D20CS-U-U-U-U-U-B-U-U-U-U	2 mA to 5V Current Input Adapter [High Precision] [530-0108]
530-0086	2.5 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-C-U-U-U-U	.5 mA to 5V Current Input Adapter [530-0086]
530-0045	2mA to 1V Current Input Adapter	D20CS-U-U-U-U-U-D-U-U-U-U	2mA to 1V Current Input Adapter [530-0045]
530-0131	12.8 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-E-U-U-U-U	12.8 mA to 5V Current Input Adapter [530-0131]
530-0052	20 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-F-U-U-U-U	20 mA to 5V Current Input Adapter [530-0052]
530-0086	50 mA to 5V Current Input Adapter	D20CS-U-U-U-U-U-G-U-U-U-U	50 mA to 5V Current Input Adapter [530-0086]

D20C output adapters

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
530-0083	Voltage Output Adapter	D20CS-U-U-U-U-U-H-U-U-U-U-U	Voltage Output Adapter [530-0083]
530-0079	1mA Current Output Adapter	D20CS-U-U-U-U-U-I-U-U-U-U-U	1mA Current Output Adapter [530-0079]
530-0080	5mA Current Output Adapter	D20CS-U-U-U-U-U-J-U-U-U-U-U	5mA Current Output Adapter [530-0080]
530-0081	10mA Current Output Adapter	D20CS-U-U-U-U-U-K-U-U-U-U-U	10mA Current Output Adapter [530-0081]
530-0082	20mA Current Output Adapter	D20CS-U-U-U-U-U-L-U-U-U-U-U	20mA Current Output Adapter [530-0082]

D20C WESDAC daughter cards

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
540-0162	WESDAC D20C D.20 Wesmaint Interface (LV)	D20CS-U-U-U-U-U-U-U-U-U-U-A	WESDAC D20C LV Wesmaint Interface Module [540-0162]
540-0209	WESDAC D20C D.20 Wesmaint Interface (HV)	D20CS-U-U-U-U-U-U-U-U-U-U-B	WESDAC D20C HV Wesmaint Interface Module [540-0209
540-0166	WESDAC D20C Analog I/O	D20CS-U-U-U-U-U-U-U-U-U-U-C	WESDAC D20C LV 8 Analog Input / 8 Analog Output Expansion Module [540-0166]
540-0159	WESDAC D20C Analog I/P (LV)	D20CS-U-U-U-U-U-U-U-U-U-U-D	WESDAC D20C LV 16 Analog Input Expansion Module [540-0159]
540-0205	WESDAC D20C Analog I/P (HV)	D20CS-U-U-U-U-U-U-U-U-U-U-E	WESDAC D20C HV 16 Analog Input Expansion Module [540-0205]
540-0227	WESDAC D20 CHV Analog I/O DB	D20CS-U-U-U-U-U-U-U-U-U-U-F	WESDAC D20C HV 8 Analog Input / 8 Analog Output Expansion Module [540-0227]

D20K control modules, spare cross-reference

Legacy and new part numbers are listed for:

- "D20K WESTERM modules" on page 197
- "D20K WESDAC modules" on page 198
- "DNP3k WESDAC modules" on page 198

D20K WESTERM modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
517-0164	WESTERM D20K Type 1 Version 1	D20K-TL-P-UU	D20K LV (20-60VDC or D.20 Power), Compression Termination
517-0164-CC	WESTERM D20K Type 1 Version 1 (Conformal Coated)	D20K-TL-P-CU	D20K LV (20-60VDC or D.20 Power), Compression Termination, Conformal Coated
517-0143	WESTERM D20 KR	D20K-TL-D-UU	D20KR LV (20-60VDC or D.20 Power), DB25 Termination
517-0143-CC	WESTERM D20 KR (Conformal Coated)	D20K-TL-D-CU	D20KR LV (20-60VDC or D.20 Power), DB25 Termination, Conformal Coated
517-0218	WESTERM D20KX W/TB Plugs	D20K-TL-X-UU	D20KX LV (20-60VDC or D.20 Power), Compression Disconnect Termination
517-0218-CC	WESTERM D20KX W/TB Plugs (Conformal Coated)	D20K-TL-X-CU	D20KX LV (20-60VDC or D.20 Power), Compression Disconnect Termination, Conformal Coated
517-0242	WESTERM D20 K4Z	D20K-TH-P-UU	D20K4Z HV (40-150VDC or D.20 Power), Compression Termination

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
517-0242-CC	WESTERM D20 K4Z (Conformal Coated)	D20K-TH-P-CU	D20K4Z HV (40-150VDC or D.20 Power), Compression termination, Conformal Coated
517-0242 - ECC	WESTERM D20 K4Z - Epoxy Conformal Coat	D20K-TH-P-EU	D20K4Z HV (40-150VDC or D.20 Power), Compression Termination, Epoxy Conformal Coated
517-0220	WESTERM D20KR Type 2	D20K-TL-D-UW	D20KR TYPE 2 LV (20-60VDC or D.20 Power), DB25 Termination with Wire-Wrap adapter option
517-0250	WESTERM D20 OKR	D20K-TL-D-UR	D20 OKR LV (20-60VDC or D.20 input), Compression Termination, redundant D.20 and PS Input

D20K WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
508-0101	WESDAC D20K Type 1 Version 1	D20K-DL-U-UU	WESDAC D20K LV
508-0101-CC	WESDAC D20K Type 1 Version 1 (Conformal Coated)	D20K-DL-U-CU	WESDAC D20K LV, Conformal Coated
508-0102	WESDAC D20K HV	D20K-DH-U-UU	WESDAC D20K HV
508-0102-CC	WESDAC D20K HV (Conformal Coated)	D20K-DH-U-CU	WESDAC D20K HV, Conformal Coated
508-0102-ECC	WESDAC D20 KHV - Epoxy Conformal Coat	D20K-DH-U-EU	WESDAC D20K HV, Epoxy Conformal Coated

DNP3k WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
508-0301	DNP I/O Module - Control	D20K-3L-U-UU	WESDAC D20K LV, DNP3 Communications
508-0301-CC	DNP I/O Module - Control (Conformal Coated)	D20K-3L-U-CU	WESDAC D20K LV, DNP3 Communications, Conformal Coated
508-0302	DNP I/O Module - Control HV	D20K-3H-U-UU	WESDAC D20K HV, DNP3 Communications
508-0302-CC	DNP I/O Module - Control HV (Conformal Coated)	D20K-3H-U-CU	WESDAC D20K HV, DNP3 Communications, Conformal Coated

D20S status modules, spare cross-reference

Legacy and new part numbers are listed for:

D20S WESTERM modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
517-0165	WESTERM D20S Type 1 Version 1	D20S-TL-P-U-S	D20S LV (20-60VDC or D.20 Power) Compression Termination
517-0165-CC	WESTERM D20S Type 1 Version 1 - Conformal Coated	D20S-TL-P-C-S)	D20S LV (20-60VDC or D.20 Power) Compression Termination, Conformal Coated
517-0165-ECC	WESTERM D20S Type 1 Version 1 - Epoxy Conformal Coated	D20S-TL-P-E-S	D20S LV (20-60VDC or D.20 Power) Compression Termination, Epoxy Conformal Coated

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
517-0179	WESTERM D20 SD	D20S-TL-D-U-S	D20SD LV (20-60VDC or D.20 Power) DB25 Termination
517-0179-CC	WESTERM D20 SD - Conformal Coated	D20S-TL-D-C-S	D20SD LV (20-60VDC or D.20 Power) DB25 Termination, Conformal Coated
517-0179-ECC	WESTERM D20 SD - Epoxy Conformal Coated	D20S-TL-D-E-S	D20SD LV (20-60VDC or D.20 Power) DB25 Termination, Epoxy Conformal Coated
517-0219	WESTERM D20SX W/TB Plugs	D20S-TL-X-U-S	D20SX LV (20-60VDC or D.20 Power) Compression/ Disconnect Termination
517-0219-CC	WESTERM D20SX W/TB Plugs - Conformal Coated	D20S-TL-X-C-S	D20SX LV (20-60VDC or D.20 Power) Compression/ Disconnect Termination Conformal Coated
517-0219-ECC	WESTERM D20SX W/TB Plugs - Epoxy Conformal Coated	D20S-TL-X-E-S	D20SX LV (20-60VDC or D.20 Power) Compression/ Disconnect Termination Epoxy Conformal Coated
517-0327	WESTERM D20SB	D20S-TL-B-U-S	D20SB LV (20-60VDC or D.20 Power) Barrier Termination
517-0327-CC	WESTERM D20SB - Conformal Coated	D20S-TL-B-C-S	D20SB LV (20-60VDC or D.20 Power) Barrier Termination, Conformal Coated
517-0327-ECC	WESTERM D20SB - Epoxy Conformal Coated	D20S-TL-B-E-S	D20SB LV (20-60VDC or D.20 Power) Barrier Termination, Epoxy Conformal Coated
517-0330	WESTERM D20 SDI, 24V	D20S-TL-D-U-I-024	D20SDI-24 LV (20-60VDC or D.20 Power) DB25 Termination
517-0331	WESTERM D20 SDI, 48V	D20S-TL-D-U-I-048	D20SDI-48 LV (20-60VDC or D.20 Power) DB25 Termination
517-0262	WESTERM D20 SDI, 125V	D20S-TL-D-U-I-125	D20SDI-125 LV (20-60VDC or D.20 Power) DB25 Termination
517-0252	WESTERM D20 OSD	D20S-TM-D-U-G-048	D20 OSD LV (20-60VDC or D.20 Power), DB25 Termination, Redundant D.20 and PS Input
517-0241	WESTERM D20 SZ 48V	D20S-TH-P-U-G-048	D20SZ HV (40-150 VDC Power) Compression Termination
517-0241-CC	WESTERM D20 SZ 48V - Conformal Coated	D20S-TH-P-C-G-048	D20SZ HV (40-150 VDC Power) Compression Termination, Conformal Coated
517-0249	WESTERM D20 SZ 110V	D20S-TH-P-U-G-110	D20SZ HV (40-150 VDC Power) Compression Termination
517-0249-ECC	WESTERM D20 SZ 110V - Epoxy Conformal Coated	D20S-TH-P-E-G-110	D20SZ HV (40-150 VDC Power) Compression Termination, Epoxy Conformal Coated
517-0266	WESTERM D20 SZ2 (110/220V)	D20S--THP-U-S	D20SZ HV (40-150 VDC Power) Compression Termination
517-0366	WESTERM D20 SZ with Plugs(48V)	D20S-TH-X-U-G-048	D20SZ HV (40-150 VDC Power) Compression/ Disconnect Termination
517-0377	WESTERM D20 SZ with Plugs (24V)	D20S-TH-X-U-G-024	D20SZ HV (40-150 VDC Power) Compression Termination

D20S WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
507-0101	WESDAC D20S Type 1 Version 1	D20S-DL-U-U-U	WESDAC D20S LV
507-0101-CC	WESDAC D20S Type 1 Version 1- Conformal Coated	D20S-DL-U-U-C	WESDAC D20S LV Conformal Coated
507-0103	WESDAC D20S HV2	D20S-DH-U-U-U	WESDAC D20S HV
507-0103-CC	WESDAC D20S HV2 - Conformal Coated	D20S-DH-U-U-C	WESDAC D20S HV Conformal Coated
507-0103-ECC	WESDAC D20S HV2 - Epoxy Conformal Coated	D20S-DH-U-U-E	WESDAC D20S HV Epoxy Conformal Coated

DNP3S WESDAC modules

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
507-0301	DNP I/O Module - Digital Input	D20S-3L-U-U-U	WESDAC D20S LV, DNP3 Communications
507-0301-CC	DNP I/O Module - Digital Input - Conformal Coated	D20S-3L-U-U-C	WESDAC D20S LV, DNP3 Communications, Conformal Coated
507-0303	DNP I/O Module - Digital Input HV	D20S-3H-U-U-U	WESDAC D20S HV, DNP3 Communications
507-0303-CC	DNP I/O Module - Digital Input HV - Conformal Coated	D20S-3H-U-U-C	WESDAC D20S HV, DNP3 Communications, Conformal Coated

D20S RNET adapter pack

Legacy Part Number	Description	New Part Number - Smart Catalog Number Prefix	Description
245-0009	12V Digital Input Adapter	D20S-U-U-U-U-U-012-U-U-U	12 V Digital Input Adapter - Set of 25
245-0030	24V Digital Input Adapter	D20S-U-U-U-U-U-024-U-U-U	24 V Digital Input Adapter - Set of 17
245-0029	24V Digital Input Adapter	D20S-U-U-U-U-U-024-U-U-U	24 V Digital Input Adapter - Set of 8
245-0004	48V Digital Input Adapter	D20S-U-U-U-U-U-048-U-U-U	48 V Digital Input Adapter - Set of 25
245-0012	110V Digital Input Adapter	D20S-U-U-U-U-U-110-U-U-U	110 V Digital Input Adapter - Set of 24
530-0133	125V Digital Input Adapter	D20S-U-U-U-U-U-125-U-U-U	125 V Digital Input Adapter - Set of 25
530-0133	220V Digital Input Adapter	D20S-U-U-U-U-U-220-U-U-U	220 V Digital Input Adapter - Set of 24

D20MX Substation Controller

Appendix G: Product Combinations

The D20MX is available in three versions:

- 526-3001LF: D20MX CPU, 2 x 10/100/1000 Base TX Front Access ports (RJ45)
- 526-3003LF: D20MX CPU, 2 x 100 Base FX Front access ports (ST Connectors)
- 526-3005LF: D20MX CPU, 2 x 100 Base FX Rear Access ports (ST Connectors)

This appendix describes the compatibility of the D20MX (3 versions) with the D20 products.

Module compatibility

Only one D20MX processor module can be installed in a D20. Additional D20MX processor modules are not required and are not compatible.

The D20MX does not require and is not compatible with D20ME Memory Expansion and Media Interface Modules.

Use the following tables to check the compatibility of the components you want to combine:

Table 82: D20 VME Chassis Compatibility

Component	GE Item #	Description	Compatible Releases
Chassis	500-0280*	Chassis Assembly D20 M (VME 3U)	REL 16A or higher
Backplane	517-0123	WESTERM D20 M VME	REL 03 or higher
WESTERM	517-0225	WESTERM D20M+, Panel Mount	REL 09 or higher
	517-0230	WESTERM D20 Assembly, Chassis Mount	All
Power Supply	580-2004	D20 Power Supply, 20-60VDC IN, 24V ISO Out	All
	580-2005	D20 Power Supply, 20-60VDC In, 48V ISO Out	All
	580-2006	D20 PS, 85-300VDC/85-264VAC In, 24V ISO Out	All
	580-2007	D20 PS, 85-300VDC or 85-264VAC In, 48V ISO Out	All

* 0V cable required from Westerm to Backplane

Table 83: D20 Non-VME Chassis Compatibility

Component	GE Item #	Description	Compatible Releases
Chassis	500-0305	Chassis, D20M+ Single Slot	REL 26 or higher
Westerm	517-0224	WESTERM D20M+, Single Slot	REL 15 or higher
Power Supply	580-2004	D20 Power Supply, 20 to 60VDC In, 24V ISO Out	All
	580-2005	D20 Power Supply, 20 to 60VDC In, 48V ISO Out	All
	580-2006	D20 Power Supply, 85 to 300VDC or 85 to 264VAC In, 24V ISO Out	All
	580-2007	D20 Power Supply, 85 to 300VDC or 85 to 264VAC In, 48V ISO Out	All

Table 84: Modem Compatibility

Component	GE Item #	Description	Compatible Unit
BIN	520-0120	WESDAC D20 202/V.23 Modem	None
BIN	580-0771	Modem, Telenetics 14.4K DIALUP	All
Stand-alone	580-2062	WESTERMO IND Telemodem, TD-34 LV	Dial-up PASS

Table 85: D20A Analog Input Module Compatibility

Component	GE Item #	Description	Compatible Releases
WESDAC	511-0101	WESDAC D20A Type 1 Version 1	REL 21 or higher
WESTERM	517-0163	WESTERM D20A Type 1 Version 1	All
	517-0178	WESTERM D20 AD	All
2nd D.20 card	540-0207	WESDAC D20 ASK D.20 Interface	All
PCOMMON	306	PCOMMON v3.06	All
	305	PCOMMON v3.05	All
	301	PCOMMON v3.01	All
	300	PCOMMON v3.00	All

Table 86: D20S Status Input Module Compatibility

Component	GE Item #	Description	Compatible Releases
WESDAC	507-0101	WESDAC D20S Type 1 Version 1	REL 18 or higher
WESTERM	517-0165	WESTERM D20S Type 1 Version 1	All
2nd D.20 card	540-0207	WESDAC D20 ASK D.20 Interface	All
PCOMMON	306	PCOMMON v3.06	All
	305	PCOMMON v3.05	All
	301	PCOMMON v3.01	All
	300	PCOMMON v3.00	All

Table 87: D20K Control Output Module Compatibility

Component	GE Item #	Description	Compatible Releases
WESDAC	508-0101	WESDAC D20K Type 1 Version 1	REL 17 or higher
WESTERM 2nd D.20 card	517-0164	WESTERM D20K Type 1 Version 1	All
	540-0207	WESDAC D20 ASK D.20 Interface	All
PCOMMON	306	PCOMMON v3.06	All
	305	PCOMMON v3.05	All
	301	PCOMMON v3.01	All
	300	PCOMMON v3.00	All

Table 88: D20C Combination Input/Output Module Compatibility

Component	GE Item #	Description	Compatible Releases
WESDAC	504-0002	WESDAC D20C+	REL 20 or higher
WESTERM	517-0180	WESTERM D20 CD	All
2nd D.20 card	540-0209	WESDAC D20C D.20/WESMAINT Interface	All
PCOMMON	305	PCOMMON v3.05	All
	300	PCOMMON v3.00	All

Table 89: D20AC Input Module Compatibility

Component	GE Item #	Description	Compatible Releases
WESDAC	511-0106	WESDAC D20 AC 20 to 60V	All
WESTERM	517-0370	WESTERM D20 AC 3V/3I	All
2nd D.20 card	540-0207	WESDAC D20 ASK D.20 Interface	All
pBOOT	104	pBOOT 1.04	All
	103	pBOOT 1.03	All
	102	pBOOT 1.02	All

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Appendix H: WESMAINT Error Log Messages

This appendix describes all WESMAINT messages logged by the system that are not described in any application Configuration Guide. This appendix includes error messages for the Internet Protocol Stack (B100) and ROOT; where ROOT is the process that launches D20MX applications.

Messages are displayed by the WESMAINT logger in the following format:

<P-NAME>: <MESSAGE>

where:

P-NAME is the process name as displayed by the SHELL.

MESSAGE is the actual message as described in the following tables.

For the Internet Protocol Stack, the process name is either B100 or ROOT.

For ROOT, this process name is ROOT.

Messages logged to the WESMAINT Error Log are classified in three categories:

- Informational messages
- Fatal error messages
- Warnings

Use the following tables to find the cause and remedy for these messages:

- Table 90, “Internet Protocol Stack error messages: cause and remedy”
- Table 91, “ROOT error messages: cause and remedy”

Table 90: Internet Protocol Stack error messages: cause and remedy

Message	Cause	Remedy
Error Messages		
E3: Unable to create interface table <x>	The Internet Protocol Stack was unable to create the Interface Current Table (B100CURR) in NVRAM. The table create attempt failed with a system error code of <x>.	Contact GE Digital Energy Technical Support and report this error.
E4: Memory alloc failure <Size=<x>>	The application was unable to allocate <x> bytes of RAM for the run-time structures required.	Contact GE Digital Energy Technical Support and report this error.
E18: Interface x cannot be added - table full.	The Internet Protocol Stack needed to add interface "x" to the B100CURR table, but the table was full. The table was designed to handle a maximum of eight interfaces.	Contact GE Digital Energy Technical Support and report this error.
E24: x route dst y socket err <z>	The Internet Protocol Stack failed to perform the operation "x" (ADD or DEL) to the route indicated by "y" due to a socket() function error <z>.	Contact GE Digital Energy Technical Support and report this error.
E25: x route dest y - send err <z>	The Internet Protocol Stack failed to perform the operation "x" (ADD or DEL) to the route indicated by y due to a send() function error <z>.	Contact GE Digital Energy Technical Support and report this error.
E30: x route dest y - mesg err <code>.	The Internet Protocol Stack failed to perform the operation "x" (ADD or DEL) to the route indicated by y due to error indicated by routing message response <z>.	Contact GE Digital Energy Technical Support and report this error.
E31: x route dest y - recv err <code>	The Internet Protocol Stack failed to perform the operation "x" (ADD or DEL) to the route indicated by y due to a recv() function error <z>.	Change the IP address for the Ethernet interface as indicated in the "Cause" paragraph.
Warning Messages		
W11: Configured interface <x> does not exist	Table B100_IF has a configured interface type which is not supported by any network interface drivers present on this host, OR has a configured interface type which is supported, but has a unit number which exceeds the maximum number of units supported by the network interface driver.	Contact GE Digital Energy Technical Support and report this error.
W12: Configured interface <x> has invalid name	Table B100_IF has a configured interface type which is not 2 characters in length, or a unit number which is outside the range of 1 to 99.	Contact GE Digital Energy Technical Support and report this error.
Information Messages		
I7: Device <x>: IP=<y> Netmask=<z>	The interface named <x> has been successfully assigned an IP address and netmask.	N/A
I8: BOOTP is not supported	A configuration with BOOTP Client enabled was downloaded to the D20MX.	In the BOOTP Settings of the D20 device properties, ensure Not Used is checked.

Table 91: ROOT error messages: cause and remedy

Message	Cause	Remedy
Error Messages		
E301: Licensed application <x> NOT started - Group:<y>	Licensed application is configured but not started, because correct software license is not available. Where <x> is application name and <y> is Group ID	1) Disable the application in the configuration. 2) Enable the trial period for the group. See "Software (feature) licensing" on page 101. 3) Purchase a license for the group (Contact GE Digital Energy Technical Support for further information)
E302a: <x> Licensed application was NOT started	Applications are not started due to licensing issues, where x is the number of applications	E302 errors will be preceded by one or more E301 errors. Once all E301 errors have been resolved, the E302 error will no longer occur.
E302b: System not operating correctly	System is not operating correctly because correct software license is not available. Even applications that are not licensed may fail to start.	
Warning Messages		
W1: Pri & Sec F/W differ. Type COMMIT or REVERT in SHELL	There are different firmware versions in primary and secondary storage locations	Type **commit** in the D20M Shell to commit the firmware to secondary storage. See "Committing new firmware" on page 82. Type **revert** in the D20M Shell to recover the previous version of the firmware. See "Reverting to old firmware" on page 83.
W001: IP of <x> same as CCUA or W001: IP of <x> same as CCUB	When transferring a redundant D20 in a ConfigPro or SGConfig project configuration to a D20MX the new D20MX standby IP addresses conflict with other devices in the project, where <x> is the host name of the device with a conflicting IP address.	Disable the standby IP addresses or reassign them. See "IP addresses" on page 60.

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Appendix H: List of Acronyms

Acronym Definitions

This Appendix lists and defines the acronyms used in this manual.

Table 92: Acronym list

Acronym	Definition
A	Amperes, unit of measure
AEL	Accessible Emission Limit
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
ASDU	Application Service Data Units
AWG	American Wire Gauge, unit of measure
bps	bits per second, unit of measure
CCU	Central Control Unit
CE Mark	Mandatory conformity mark for products placed on the market in the European Economic Area (EEA)
CISPR	Special international committee on radio interference
COM1/COM2	Communications port
CPU	Central Processing Unit
CTS	Clear To Send
dBm	decibel-milliwatt, unit of measure - an electrical power unit in decibel (dB)
DCA	Data Collection Application
DCD	Data Carrier Detect
DNP	Distributed Network Protocol
DoC	Declaration of Conformity: States which CE mark directive(s) has been met and includes a signature of a company official indicating the company's responsibility for its CE mark compliance claim.
DPA	Data Processing Application
DST	Daylight Saving Time

Acronym	Definition
DTA	Data Transmission Application
DTE	Data Terminal Equipment
EIA	Electronic Industries Alliance
EMC	Electromagnetic Capability
EMI	Electromagnetic Interference
EPLD	Erasable Programmable Logic Device
EPUP	Environmental Protection Use Period
ESD	ElectroStatic Discharge
EU	European Union
FEFI	Far End Fault
FPGA	Field-Programmable Gate Array
GE	General Electric
GFO	Glass Fiber Optic
GOF	glass optical fiber
HCS	Hard Clad Silica
HDLC	High-level Data Link Control
HMI	Human Machine Interface (also called Graphical User Interface – GUI)
HSP	Hardware Support Package
Hz	Hertz, unit of measure for frequency
I/O	Input/Output
IEC	International Electrotechnical Commission Standards
IED	Intelligent Electronic Device
ILS	Instrument Landing System
in-lb	inch-pound, unit of measure for energy
IRIG-B	Inter Range Instrumentation Group (IRIG) - an American standardized network time code format
kbps	kilo bits per second, unit of measure
LAN	Local Area Network
lb	pound, unit of measure for weight
LC	Lucent connector; A type of fiber-optic cable connector
LED	Light Emitting Diode
LLA	Loss Link Alert
LRU	Logical Remote Unit
LV	Low Voltage
LVD	Low Voltage Directives (CE Mark)
Mb	Mega bits, unit of measure
MB	Mega bytes, unit of measure
Mbps	Mega bits per second, unit of measure
MBps	Mega bytes per second, unit of measure
MCV	Maximum Concentration Values
MD5	Message Digest 5 (check data integrity)
MDI	Medium Dependent Interface
MDIX	Medium Dependent Interface, Crossover
ms	milliseconds, unit of measure
Nm	Newton-meter, measure of energy
NTP	Network Time Protocol
NVRAM	Non-Volatile Random Access Memory

Acronym	Definition
PC	Personal Computer
PCBA	Printed Circuit Board Assembly
PFO	Plastic Fiber Optic
PG&E	Pacific Gas and Electric
PID	Proportional, Integral and Derivative
PIM	Privileged Identity Management
PPM	Parts Per Million
pSOS	Type of operating system
RMA	Return Merchandise Authorization
RoHS	Restriction of Hazardous Substances
RTC	Real Time Clock
RTS	Request To Send
RTU	Remote Terminal Unit
RU	Rack Unit
Rx	Receive
RXD	Receive Data
SA COM	Serial Analyze Communications
SCADA	Supervisory Control and Data Acquisition
SCP	Secure Copy application
SEL	Schweitzer Engineering Laboratories
SNTP	Simple Network Time Protocol
SOE	Sequence Of Events
SQL™	Structured Query Language
SRU	Sub-Remote Unit
ST	Straight Tip connector; A type of fiber-optic cable connector
STP	Spanning Tree Protocol
TIA	Telecommunication Industries Association
Tx	Transmit
TXD	Transmit Data
UART	Universal Asynchronous Receiver-Transmitter
UPC	Universal Protocol Converter
UTC	Universal Time Coordination
UTP	Unshielded Twisted Pair
VA	Volt Amps, unit of measure
V AC	Volts, Alternating Current, unit of measure
V DC	Volts, Direct Current, unit of measure
VME	Versa Module Eurocard
WinSCP	Windows Secure CoPy

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Appendix I: Miscellaneous

This appendix provides the warranty and revision history.

Warranty

For products shipped as of 1 October 2013, GE Digital Energy warrants most of its GE manufactured products for 10 years. For warranty details including any limitations and disclaimers, see the GE Digital Energy Terms and Conditions at https://www.gedigitalenergy.com/multilin/warranty.htm

For products shipped before 1 October 2013, the standard 24-month warranty applies.

Revision history

Version	Revision	Date	Change Description
1.00	0	October 17, 2012	Original release of this document.
	1	November 6, 2012	Updated D20 applications table and added Firmware/FPGA versions table.
	2	November 23, 2012	Added sections for: Update to the SAN0001 firmware option, Transfer D20/D200 configurations to the D20MX, and Updating D20/D200 Configurations to use the D20MX firmware definition with ConfigPro. Added an Appendix for Resetting a read/write user password.
	3	January 11, 2013	Updated procedures for configuring redundant D20MX devices in the Software Configuration chapter.
1.10	0	March 1, 2013	Updated the D20MX applications table. Added Migrate D20MX application definitions to SGConfig section.
1.20	0	July 15, 2013	Updated the D20MX application tables, order code table, upgrade kit order code table, procedures in Chapter 5, and Added Appendix D.
1.21	0	September 13, 2013	Updated for firmware version 1.21.

Version	Revision	Date	Change Description
1.30	0	January 7, 2013	Renamed to the D20MX Instruction manual. Added Chapter 8: Removing Configuration Data and Sensitive Information from the D20MX. Added Appendix E: Secure Connection for LogicLinx. Updated for firmware version 1.30.
1.31	0	March 13, 2014	Updated for firmware version 1.31.
1.32	0	May 7, 2014	Updated for firmware version 1.32.
	1	May 16, 2014	Updated for firmware version 1.32 revision 1.
1.3x	0	July 10, 2014	Updated for firmware version 1.33 revision 0.
1.4x	0	Sep 2, 2014	Updated for firmware version 1.40 revision 0.
	1	Sep 11, 2014	Changed Note in Twisted Pair Ethernet connection for STP.
	2	Feb 27, 2015	Added content to the Grounding the D20MX section regarding potential electrical surge or ESD damage. Added content to the RS-232 section regarding use of both the front and rear RS-232 ports. Updated Appendix: Default Role-based Access Control Module for Read Access tables > Not Used bits for some applications.
1.5x	0	July 6, 201	Updated for firmware version 1.5x revision 0. Added serial expansion.

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