

Multilin™ D20E

Ethernet I/O Module



Installation and Maintenance Guide

994-0145
Version 1.00 Revision 4

DAPserver Studio Version:6.2.0-4



Building a world that works

GE Information

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D20E Ethernet I/O Module

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D20E Ethernet I/O Module

Product Support

If you need help with any aspect of your GE Grid Solutions product, you can:

- Access the GE Grid Solutions Web site
- Search the GE Technical Support library
- Contact Technical Support

Also covered are:

- The GE Grid Solutions address
- Instructions on returning a D20E to GE Grid Solutions
- Additional product documents which support
- Firmware upgrade information

Access the GE Grid Solutions Web site

The GE Grid Solutions 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.gegridsolutions.com>

Search GE Grid Solutions technical support library

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

http://sc.ge.com/*SASTechSupport

Contact GE Grid Solutions technical support

GE Grid Solutions 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 Technical Support:

- 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

Technical Support provides you with a case number for your reference.

GE Grid Solutions address

The GE Grid Solutions company address is:

GE Grid Solutions
650 Markland Street
Markham, Ontario
Canada L6C 0M1

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 Grid Solutions 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 Grid Solutions.



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

D20E Ethernet I/O Module

About this Document

Purpose

This manual provides:

- Information about installing, setting up, using and maintaining your Multilin™ D20E Ethernet I/O Module.
- Procedures for configuring and communicating with the D20E module. Once these procedures are complete, you can view live data on the D20E module as well as modify the configuration for the utility system.
- Product safety information, as well as, hardware and software interface and connections for the D20E Ethernet I/O Module.
- A description of the hardware configuration settings and installation requirements.

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
- Other related manufacturers' products, such as protective relays and communications equipment

Example module being configured and monitored

This manual does not describe the configuration of each D20E module, but often describes the D20E-C (Combination I/O) module as an example.

The DAPserver Studio firmware 6.2.0-4 or greater, is used to configure and monitor the D20E modules.

Additional documentation

For the most current version of the D20E Ethernet I/O Module Instruction Manual, please download a copy from:

<http://www.gedigitalenergy.com/multilin/energy/catalog/d20e.htm>

For further instructions on using DAPserver Studio, refer to the:

- DAPserver Studio Online Help
- DAPserver Studio User Guide

GE Grid Solutions and Alstom product naming

The following table provides a cross-references of the GE Grid Solutions IO module product names, and the equivalent legacy Alstom product names:

Product description	Product name	
	Alstom	GE Grid Solutions
Combination I/O module (mixed I/O module)	DAP-MIO	D20E-C
Analog Input module	DAP-AI	D20E-A
Digital Input (status) module	DAP-DI	D20E-S
Digital Output (control) module	DAP-CO	D20E-K
Digital Output (control) module - interface to DB25	DAP-CR Interface	D20E-K: Control Peripheral, DB25

Form C point references

The D20E Ethernet I/O Module supports Form C points.



GE Grid Solutions legacy products, such as the D.20 I/O module, provide document references to Form C points, which are more accurately described as dual points.

How to use this manual

This manual describes how to install the D20E and get it up and running for the first time. The software-related procedures in this manual are based on using a computer running Windows® 7 or later. Some steps and dialog boxes may vary slightly if you are using another version of Windows.

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.

D20E Ethernet I/O Module

Chapter 1: Before You Start

The D20E Ethernet I/O Modules provide digital input, control output and analog input interfaces, as well as, a mixed interface I/O unit.

These products can be integrated with GE Grid Solutions D400, DAP-416, DMC490, and D2x substation automation products or installed as stand-alone I/O modules with either DNP3 TCP/IP subset level 2 or IEC 61850 GGIO server network protocols.

Before you begin installing and using the D20E, review the information in this chapter, including the following topics:

- [Product overview](#) on page 16
- [Safety precautions](#) on page 17
- [Hardware overview](#) on page 20
- [Configure device firmware](#) on page 21
- [Ordering guides](#) on page 23
- [Specifications](#) on page 26
- [RoHS compliance](#) on page 33
- [Storage recommendations](#) on page 34

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



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

Product overview

The D20E Ethernet I/O Module set is comprised of the:

- D20E-C module; 16 digital inputs, 8 control outputs and 16 analog inputs; see Figure 1
- D20E-S module; 64 digital (status) inputs; see Figure 2
- D20E-K module; 32 control outputs; see Figure 3
- D20E-A module; 32 analog inputs; see Figure 4

Figure 1: D20E-C (combination inputs/outputs) module front panel

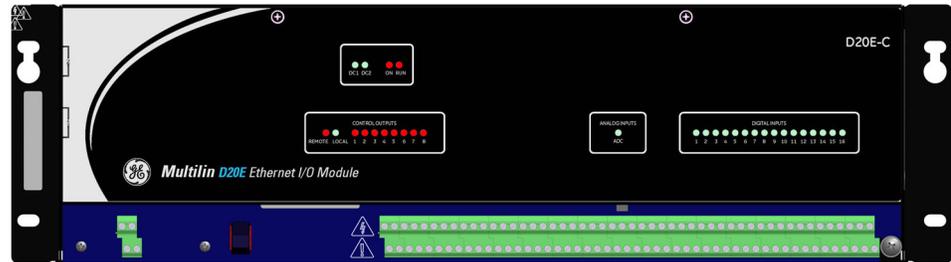


Figure 2: D20E-S (status digital inputs) module front panel

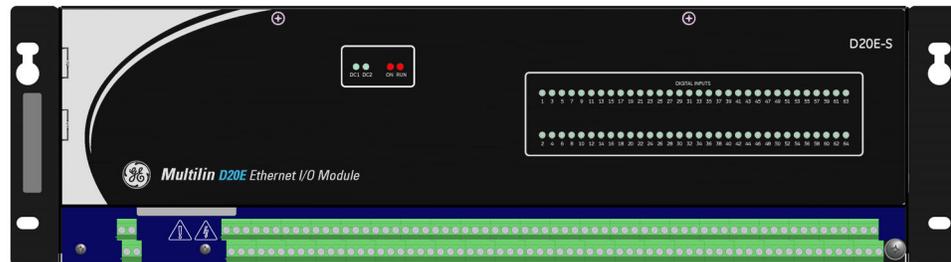


Figure 3: D20E-K (control digital outputs) module front panel

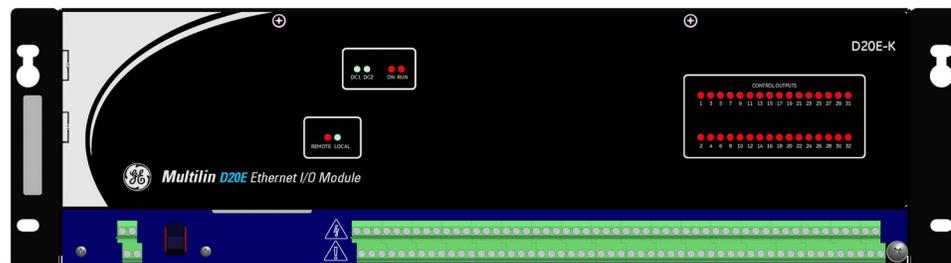


Figure 4: D20E-A (analog inputs) module front panel



Comparing D20E to D.20 I/O module operation

The D20E Ethernet I/O Module is a new product that is similar in functionality to the legacy GE Grid Solutions D.20 I/O modules.

However, some aspects of the D20E I/O module operation is quite different from that of the D.20 I/O module. For example, on the D20E module the:

- R/L (Raise/Lower) Digital Output point uses the T/C (Trip/Close) WESMAINT command
- R/L (Raise/Lower) Digital Output does not support simultaneous operations on two different points
- T/C (Trip/Close) Digital Output point does not support a repeat count as does the D.20 module.

Always refer to this manual when starting to install, configure, and operate the D20E.

Safety precautions



High voltage

High voltage may be present on TB2 terminal block connections for control outputs and digital inputs.

WARNING

- Ensure that the module is attached to the protective earth ground at the connection point shown in Figure 15.
- Many of the components within the D20E Ethernet I/O Modules are susceptible to damage from electrostatic discharge (ESD). Always apply ESD precautions when the top cover is removed.
- Ensure that cable shields are grounded at either the D20E module ground point or at the field equipment ground. Do not ground the shields at more than one point because a potential difference may exist between grounds, causing ground loops and undesirable noise sources.
- Always replace fuses with the same type and rating as those originally provided by GE Grid Solutions.
- Always use fuse-protected external DC power sources.
- The D20E requires a secondary enclosure for complete fire containment.
- To prevent interference with communications, route all network cables away from power carrying cables.
- The D20E module comes with factory configuration as ordered. Always check the order code configuration on the D20E prior to connecting field I/O.
- Do not operate the D20E if it has been dropped or damaged. Return it to GE Grid Solutions for inspection and repair.
- Input voltages and currents must be within specified limits (see [Specifications](#) on page 26) prior to connecting power sources to the D20E Ethernet I/O Module. Do not apply voltages or currents outside the range of the product specifications. Voltages or currents outside the specified range may lead to product failure.
- Only qualified personnel should work on the D20E. Maintenance personnel must 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 D20E is to be installed before installing and wiring the D20E.
- 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.
- 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 D20E 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 Grid Solutions could void the warranty.

Protective earth ground



The D20E must be attached with a 4 mm² (#12 AWG) wire and a secure ring lug earth ground connected to the safety and protective earth #10 screw and lock washer stud located at bottom right of module (see Figure 15).

Terminal blocks TB1 and TB2

For stranded wire connections to terminal blocks TB1 and TB2 use crimp ferrules.



Wiring to terminal blocks TB1 and TB2 must not have exposed accessible conductors.

Wire and cable must have at least a +80 °C temperature rating.

Warning symbols

Table 1 explains the meaning of warning symbols that may appear on the D20E.

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

Operating environment

D20E modules are intended to be installed in either 19 inch rack or in flat surface panel mounting applications, within a semi-controlled environment. Do not place the D20E products in environments where unusual conditions exist (temperature, water, corrosion or dust), unless they are within a secondary protected enclosure.

Cyber security precautions

The D20E can be deployed with a GE Grid Solutions' server (for example, D20MX or D400) or with IEDs, provided the D20E is behind the GE Grid Solutions server or IED.

NOTICE

D20E Ethernet I/O Modules are intended to be installed inside the electronic security perimeter of a system (ESP). They shall not be directly connected to another LAN, nor be used as an electronic access point (EAP). In this case, firmware upgrade and configuration change cannot be done remotely.

D20E modules are configured by default with two user accounts (that is, the root account, and the admin account). It is recommended to change the passwords for these accounts as soon as possible.

Hardware overview

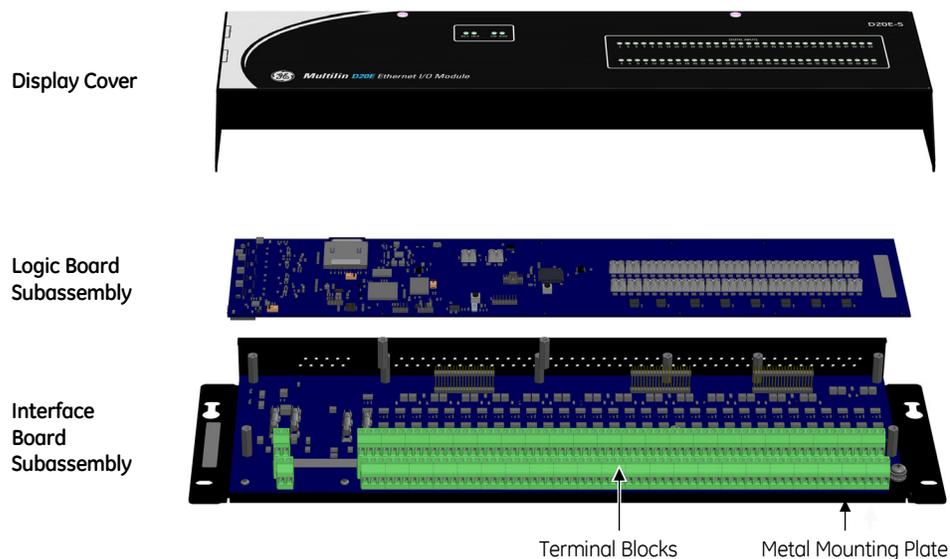
The D20E Ethernet I/O Modules are distributed network input/output modules for substation automation that support:

- 64 digital inputs
- 32 control outputs
- 32 analog inputs or
- A mix of 8 control outputs, 16 analog inputs, 16 digital inputs.

Two redundant switched LAN connections are provided using either the DNP3 TCP/IP or the IEC 61850 server protocols.

The D20E modules are highly reliable, incorporating state-of-the-art technology. They are comprised of a logic board subassembly and interface board subassembly housed on a mounting panel with an integral top cover (see Figure 5). Field connections are facilitated by compression type termination blocks.

Figure 5: D20E module sub-assemblies



Input/output configurations are factory set for digital inputs, control outputs and analog inputs. Digital inputs on the D20E-S or D20E-C modules are configured for either of the following nominal input types:

- LVDI (low voltage digital input), or
- HVDI (high voltage digital input).

Control outputs on the D20E-K or D20E-C modules are configured to one of the following:

- Trip/Close
- Form C contacts
- DPST outputs
- Raise/Lower

Analog inputs accept DC sensor or transducer signals and can be set for either voltage or current inputs on an individual per input basis.

A REMOTE/LOCAL switch is provided on both the D20E-K and D20E-C modules to enable or disable control outputs for added station maintenance safety.

Configure device firmware

The D20E firmware is a combination of program code and data stored in an embedded computer platform. The firmware is stored in non-volatile memory.

The D20E modules are connected to the D20E LAN port and then configured with DAPserver Studio V6.2.0-4 (or a later) version. For information on the LAN port connectors, see section: [Network data communication](#) on page 79.

DAPserver Studio device configuration tool

DAPserver Studio is a configuration tool for the D20E modules. which allows you to:

- Configure the D20E module for optimum performance.
- Map and translate D20E point values/status into the module server protocol, report real-time data from the connected D20E device and execute control commands from a local control point.
- Monitor D20E real-time data values, point states and system health information.

To change the module's configuration, use the DAPserver Studio **Settings** and **Sync** menu options.

Terminal emulator

You can use either the PuTTY or the Tera Term terminal emulator as a connection interface to access the D20E console USB interface. You can execute standard Linux commands from the D20E console for setup and debugging. These terminal emulators can be downloaded from:

- PuTTY: www.puttyorg.
- Tera Term: www.SourceForge.jp.

PuTTY and Tera Term are free, open-source terminal emulators which support serial console and network terminal emulation with SSH encryption.

For information on the USB 2.0 connector, see section [Console port](#) on page 78.

Data communications

The D20E module supports the following TCP/IP network based communication protocols:

- IEC 61850 GGIO server
- DNP3 server



NOTE

Redundancy is not an enabled feature on the D20E (not licensed).

DNP3 server

DNP3, the Distributed Network Protocol, is a standards-based communications protocol developed to achieve interoperability among systems in the electric utility and substation automation. This robust, flexible non-proprietary protocol is based on existing open standards to work within a variety of networks.

DNP3 in the D20E module offers flexibility and functionality which includes:

- Multiple data types (Data Objects and Variations).
- Multiple master stations are supported for D20E DNP3 server.
- Unsolicited data report is initiated from outstations to master stations.
- Data types (Objects) can be assigned priorities (Class) and be requested based on the priority.
- Time-stamped events.
- Broadcast messages.
- Data link and application layer confirmation and configurable.

Ordering guides

The latest ordering guides are available on the GE Grid Solutions website at:

<http://www.gedigitalenergy.com/multilin/energy/catalog/d20e.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 Table 2.

Table 2: D20E Ethernet I/O Module order codes

D20E Type	D20E	-	*	-	*	*	-	*	0	0	*	*	*	-	*	*	*	-	*	*
(K) - Control (Digital Outputs) I/O Module	K																			
(S) - Status (Digital Inputs) I/O Module	S																			
(A) - Analog Inputs I/O Module	A																			
(C) - Combination output/Input I/O Module	C																			
(I) - Interposer Relay Termination Panel	I																			
Peripheral Options	D20E	-	*	-	*	*	-	*	0	0	*	*	*	-	*	*	*	-	*	*
(1-100-000) - Control Peripheral, Compression disconnect, Trip/Close, 20 to 60 VDC, 2x10/100 Base-T (517-0504LF, 508-0501LF)	K	1	1	0	0	0	0	0	0	0										
(0-100-000) - Control Peripheral, Standard Compression, Trip/Close, 20 to 60 VDC, 2x10/100 Base-T (517-0503LF, 508-0501LF)	K	0	1	0	0	0	0	0	0	0										
(2-100-000) - Control Peripheral, DB25, Trip/Close, 20 to 60 VDC, 2x10/100 Base-T (517-0505LF, 508-0501LF). D20E-K (DB25) interface connects to WESTERM D20KI 517-0143 with cable 977-0069	K	2	1	0	0	0	0	0	0	0										
(0-000-100) - Digital Inputs Peripheral, Standard Compression, 20 to 60 VDC LVDI, 20 to 60 VDC, 2X10/100 Base-T (517-0506LF, 507-0501LF)	S	0	0	0	0	1	0	0	0	0										
(0-000-200) - Digital Inputs Peripheral, Standard Compression, 90 to 290 VDC HVDI, 20 to 60 VDC, 2X10/100 Base-T (517-0507LF, 507-0501LF)	S	0	0	0	0	2	0	0	0	0										
(1-000-100) - Digital Inputs Peripheral, Compression disconnect, 20 to 60 VDC LVDI, 20 to 60 VDC, 2X10/100 Base-T (517-0508LF, 507-0501LF)	S	1	0	0	0	1	0	0	0	0										
(1-000-200) - Digital Inputs Peripheral, Compression disconnect, 90 to 290 VDC HVDI, 20 to 60 VDC, 2X10/100 Base-T (517-0509LF, 507-0501LF)	S	1	0	0	0	2	0	0	0	0										
(1-001-000) - Analog Inputs Peripheral, Compression disconnect, 5 V Analog Input, 20 to 60 VDC, 2x 10/100 Base-T (517-0502LF, 511-0501LF)	A	1	0	0	1	0	0	0	0	0										
(0-002-000) - Analog Inputs Peripheral, Standard Compression, 20 mA Analog Input, 20 to 60 VDC, 2x 10/100 Base-T (517-0514LF, 511-0501LF)	A	0	0	0	2	0	0	0	0	0										
(0-001-000) - Analog Inputs Peripheral, Standard Compression, 5 V Analog Input, 20 to 60 VDC, 2x 10/100 Base-T (517-0501LF, 511-0501LF)	A	0	0	0	1	0	0	0	0	0										
(1-101-100) - Combination I/O Peripheral, Compression disconnect, Trip/Close, 5 V Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T (517-0512LF, 509-0501LF)	C	1	1	0	1	1	0	0	0	0										
(0-101-100) - Combination I/O Peripheral, Standard Compression, Trip/Close, 5 V Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T (517-0510LF, 509-0501LF)	C	0	1	0	1	1	0	0	0	0										
(0-102-100) - Combination I/O Peripheral, Standard Compression, Trip/Close, 20 mA Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T (517-0515LF, 509-0501LF)	C	0	1	0	2	1	0	0	0	0										
(1-102-100) - Combination I/O Peripheral, Compression disconnect, Trip/Close, 20mA Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T (517-0516LF, 509-0501LF)	C	1	1	0	2	1	0	0	0	0										
(1-101-200) - Combination I/O Peripheral, Standard Compression, Trip/Close, 5V Analog Input, 90 to 290 VDC HVDI, 20 to 60 VDC, 2x10/100 Base-T (517-0513LF, 509-0501LF)	C	1	1	0	1	2	0	0	0	0										
(0-101-200) - Combination I/O Peripheral, Standard Compression, Trip/Close, 5V Analog Input, 90-290VDC HVDI, 20 to 60 VDC, 2x10/100 Base-T (517-0511LF, 509-0501LF)	C	0	1	0	1	2	0	0	0	0										
(0-000-000) - Interposer Relay Termination Panel, Standard Compression (517-0146)	I	0	0	0	0	0	0	0	0	0										
(1-000-000) - Interposer Relay Termination Panel, Compression Disconnect (517-147LF)	I	1	0	0	0	0	0	0	0	0										

D20-E Interposer Relay Options	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*
(0) - None									0								
(1) - Momentary KUEP 10A 150V - 1X - 24V (410-0016[16])									1								
(2) - Momentary KUEP 5A 150V - 2A - 24V (410-0056[16])									2								
(3) - Momentary KUEP 3A 150V - 2C - 24 V (410-0053[16])									3								
(4) - Momentary KUP 10A 28V - 2C - 24V COIL (410-0039[16])									4								
(5) - Latching KUL 10A 28V - 2C LATCH - 24V (410-0043[8])									5								
(6) - Momentary KUEP 10A 150V - 1X - 48V (410-0041[16])									6								
(7) - Momentary KUEP 5A 150V - 2A - 48V (410-0092[16])									7								
(8) - Momentary KUP 10A 28V - 2C - 48 V (410-0044[16])									8								
(9) - Latching KUL 10A 28V - 2C LATCH - 48V (410-0045[8])									9								
D20-E RJ-45 Cables	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*
(U) - Not required												U					
(A) - Cable, UTP Patch Cord Standard, 24 inch (GE part number,977-0209/24)												A					
(B) - Cable, UTP Patch Cord Standard, 48 inch (GE part number,977-0209/48)												B					
(C) -Cable, UTP Patch Cord Standard, 60 inch (GE part number,977-0209/60)												C					
(D) - Cable, UTP Patch Cord Standard, 72 inch (GE part number,977-0209/72)												D					
(E) - Cable, UTP Patch Cord Standard, 84 inch (GE part number,977-0209/84)												E					
(F) - Cable, UTP Patch Cord Standard, 96 inch (GE part number,977-0207/96)												F					
D20-E USB Cable	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*
(U) - Not required												U					
(A) - Cable Assembly USB 2m 28AWG USB Type A to Micro-USB Type B M-M Bag (GE part number, 580-3767)												A					
D20-E Interposer Cables	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*
(U) - Not required												U					
(1) - D20K Interconnect Cable 24 inch (977-0069/24)												1					
(2) - D20K Interconnect Cable 30 inch (977-0069/30)												2					
(3) - D20K Interconnect Cable 36 inch (977-0069/36)												3					
(5) - D20K Interconnect Cable 48 inch (977-0069/48)												5					
(9) - D20K Interconnect Cable 72 inch (977-0069/72)												9					
(B) - D20K Interconnect Cable 96 inch (977-0069/96)												B					
(C) - D20K Interconnect Cable 120 inch (977-0069/120)												C					
(E) - D20K Interconnect Cable 240 inch (977-0069/240)												E					
(F) - D20K Interconnect Cable 300 inch (977-0069/300)												F					
(G) - D25-KI Interconnect Cable, 30 inch (977-0208/30)												G					
(H) - D25-KI Interconnect Cable, 36 inch (977-0208/36)												H					
(I) - D25-KI Interconnect Cable 48 inch (977-0208/48)												I					
(J) - D25-KI Interconnect Cable 72 inch (977-0208/72)												J					
(K) - D25-KI Interconnect Cable, 96 inch (977-0208/96)												K					
(L) - D25-KI Interconnect Cable, 240 inch (977-0208/240)												L					
D20E Power Supply	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*
(U) - Not required												U					
(A) - DIN Mount Power Supply: Input 85 to 264VAC or 90 to 350VDC, output 24VDC at 5A (580-3466)												A					
(B) - DIN Mount Power Supply: Input 85 to 264VAC or 90 to 350VDC, output 48VDC at 3.75A (580-3484)												B					

Duct Panel Options	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*	*	-*	*	
(U) - Not Required																				U	
(1) - Cable Duct Panel, Tie Wrap Connections (560-0046)																				1	
(2) - Two Cable Duct Panels, tie wrap connections (560-0046[2])																				2	
(3) - Cable Duct Panel, no through holes (560-0008)																				3	
(4) - Two Cable Duct Panels, no through holes (560-0008[2])																				4	
(5) - Cable Duct Panel, through holes at each end (560-0009)																				5	
(6) - Two Cable Duct Panels, through holes at each end																				6	
Power Cord Options	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*	*	-*	*	
(U) - Not Required																				A	
(A) - Power Cord With North America Plug (977-0547/108)																				O	
Firmware Options	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*	*	-*	*	
(A) Firmware - 6.2.0-4																				A	
(O) D20E Firmware, Latest Release																				O	
Documentation Options	D20E	-*	*	-*	*	*	-*	0	0	*	*	*	-*	*	*	-*	*	*	-*	*	
(U) - Not required																					U
(B) - SAS Product Documentation CD																					B

Specifications

D20E Ethernet I/O Modules are data collection and control devices integrated with network communication technology for smart grid and substation automation. The D20E modules are a combination of hardware and software systems with either DNP3 TCP/IP subset level 2 or IEC 61850 GGIO server protocols.

Each D20E module is designed and implemented with:

- The input/output allocation for the four different modules:
 - D20E-A: 32 DC Analog Input channels (with 32 high/low alarm points)
 - D20E-K: 32 Control Outputs (can be configured into 4 different control output types)
 - D20E-S: 64 Digital Inputs (COS and SOE)
 - D20E-C: 8 Control Outputs, 16 Analog Inputs and 16 Digital Inputs
- Four 10/100Base-T Local Area Network interfaces supporting 2 independent networks for redundancy;
- One USB 2.0 console port.
- Two DC Power Supply inputs for supporting dual mirrored power sources.



NOTE

All specifications for D20E modules are shown below. These specifications are subject to change.

Specifications are provided for:

- [Digital inputs](#) on page 27
- [Control outputs](#) on page 28
- [Analog inputs](#) on page 29
- [Power supply](#) on page 29
- [Enclosure electro-magnetic capability](#) on page 30
- [Environmental](#) on page 30
- [Physical](#) on page 30
- [Communication ports](#) on page 31

Digital inputs

Number of Digital Inputs	D20E-C: 16 bipolar D20E-S: 64 bipolar
Input Options	LVDI: 20 to 60 VDC (5 mA burden), nominal 24/48 VDC or HVDI: 90 to 290 VDC (2 mA burden), nominal 110/125/220/250 VDC Note: D20E-S 220/250 VDC derate to +60°C with 48 inputs ON
Insulation/Isolation	2800 VDC >100 MΩ
Time Tag Accuracy	On NTP, digital Input Time Tag accuracy on a D20E-S or D20E-C is ±1.0 ms after the startup period of approximately 30 minutes from power cycle or power up, and ±15 ms during the startup period.
Time Tag Resolution	1.0 ms
SOE Buffer Size	256 events
Debounce Filter	Configurable per input: <ul style="list-style-type: none"> • 1 to 1000 ms
Oscillation/Chatter Filter	Configurable per input: <ul style="list-style-type: none"> • 1 to 100 per 100 ms or 1 second period
Accumulator/Counter Input	Digital Input can be configured to running or freeze counter point <ul style="list-style-type: none"> • 100 Hz maximum • D20E-C: <ul style="list-style-type: none"> 16 Transition counter points 8 pairs Dual Point counters 16 Form A counter points 16 Form B counter points 8 pairs Form C counter points • D20E-S: <ul style="list-style-type: none"> 64 Transition counter points 32 pairs Dual Point counters 64 Form A counter points 64 Form B counter points 32 pairs Form C counter points
Local Indications	Blue LED per input <ul style="list-style-type: none"> • D20E-C: <ul style="list-style-type: none"> 16 input points • D20E-S: <ul style="list-style-type: none"> 64 input points
Conducted Immunity	As per: <ul style="list-style-type: none"> • IEEE C37.90.1 • IEC 61000-4-4 • IEC 61000-4-5 • IEC 61000-4-6 • IEC 61000-4-16

Control outputs

Control Output Configuration Options	<ul style="list-style-type: none"> D20E-C: <ul style="list-style-type: none"> 8 Form C (NO and NC) outputs 6 Form C with 2 Form A supervision outputs 8 Trip/Close pairs (reserved for backward compatibility) 8 DPST (Double Pole Single Throw) outputs 8 Form C 4 Raise/Lower pairs D20E-K: <ul style="list-style-type: none"> 32 Form C (NO and NC) outputs 32 Trip/Close pairs 32 DPST (Double Pole Single Throw) outputs 16 Raise/Lower pairs
Control Modes	<ul style="list-style-type: none"> Direct Operate Select before Operate Single Point-of-Failure Protection excluding relay contacts
Local/remote Switch	Disable or Enable control outputs and control output supply
Contact Ratings	<ul style="list-style-type: none"> 290 VDC maximum 8 A switching maximum (at 30 VDC) 4 A continuous maximum (Form C) 2 A continuous maximum (Trip/Close, Raise/Lower, DPST) 60 W Switching maximum (at 290 VDC)
Insulation/Isolation	2800 VDC >100 MΩ
Programmable Output Timers	Configurable: <ul style="list-style-type: none"> 20 to 100,000 ms
Programmable Pulse Outputs	Configurable: <ul style="list-style-type: none"> Number of pulses: 1 to 20,000 (a configuration setting value of 0 specifies continuous pulses) On/Off durations: 20 to 100,000 ms
Local Indications	Red LED per output: <ul style="list-style-type: none"> D20E-K: 1 to 32 D20E-C: 1 to 8 Remote/Local: Red/Blue LEDs
Conducted Immunity	As per: <ul style="list-style-type: none"> IEEE C37.90.1 IEC 61000-4-4 IEC 61000-4-5 IEC 61000-4-6 IEC 61000-4-16
D20E-K (DB25) Interface	<ul style="list-style-type: none"> DB25(F) connectors <ul style="list-style-type: none"> Note: Mating hood width <0.65" D20 KI interposer relay panel compatible 32 Trip/Close (30 T/C), 16 Raise Lower outputs External control supply input: 24/48 VDC nominal Dielectric insulation: 1400 VDC Conducted Immunity: IEEE C37.90.1, IEC 61000-4-4 D20E-K (DB25) interface connects to WESTERM D20KI 517-0143 with cable 977-0069

Analog inputs

Number of Analog Inputs	D20E-C: 16 differential inputs D20E-A: 32 differential inputs
Input Options	±5.0 VDC, ±1.0 mA, ±5.0 mA, ±10.0 mA, ±20.0 mA D20E Analog Input types are defined exclusively by the hard-wired scaling resistor installed at the factory. The A/D is fixed at ± 5V. Normal scaling parameters can be applied in the Publisher configuration. Note: Refer to Chapter 1, <i>Ordering guides</i> section for complete set of options currently available.
Accuracy	±0.1% FS (current), ±0.05% FS (voltage)
Input Impedance	≥1.0 MΩ (Voltage input)
Resolution	15-bit plus sign
Input Conversion Time	22 ms (per input)
Local Indications	Blue LED ADC conversion: <ul style="list-style-type: none"> • D20E-A: 2 LEDs • D20E-C: 1 LED
CMRR	90dB (at 50/60 Hz)
NMRR	60dB (at 50/60 Hz)
Insulation/Isolation	700 VDC >100 MΩ
Alarm	High/Low alarm with pseudo digital input indication
Auto-Calibration	3-point reference
Conducted Immunity	As per: <ul style="list-style-type: none"> • IEEE C37.90.1 • IEC 61000-4-4 • IEC 61000-4-5 • IEC 61000-4-6 • IEC 61000-4-16

Power supply

DC Input	20 to 60 VDC range, nominal 24/48 VDC
DC Input Mode	Dual mirror inputs DC1 and DC2; single power supply
Polarity Protection	Reverse input
Power	5 W typical
Current	0.25 A maximum
Insulation/Isolation	2250 VDC >100 MΩ
Local Indications	DC1 and DC2 Blue LEDs; Power Supply output ON Red LED
Conducted Immunity	As per: <ul style="list-style-type: none"> • IEEE C37.90.1 • IEC 61000-4-4 • IEC 61000-4-5 • IEC 61000-4-6 • IEC 61000-4-16 • IEC 61000-4-17 • IEC 61000-4-29

Enclosure electro-magnetic capability

Enclosure Immunity	As per: <ul style="list-style-type: none"> • IEEE C37.90.2 • IEEE C37.90.3 • IEC 61000-4-2 • IEC 61000-4-3 • IEC 61000-4-8
Radiated Emissions	CISPR 11 Class A

Environmental

Ambient Temperature Range	Operating: –40 °C to +75 °C (IEC 60068-2-1 and 2) Note: D20E-K and D20E-C: +75 °C IEC 61010-1 rating Storage: –40 °C to +85 °C (IEC 60068-2-1 and 2)
Humidity	<95% Relative Humidity, non-condensing at +40 °C, 96 hrs. (IEC 60068-2-78)
Altitude	2000 m (maximum)
Pollution Degree:	II
Overvoltage Category:	II
Ingress Protection:	IP30 Front
Insulation Class:	1
Enclosure Protection Rating	IP30-top, IP20-bottom (IEC 60529)
Vibration, Shock, Drop	As per: <ul style="list-style-type: none"> • IEC 60068-2-6 • IEC 60068-2-27 • IEC 60068-2-31

Physical

Form	3U, Rack/Wall-mount
Dimensions	19.0 × 5.2 × 1.6 inches; 483 × 132 × 41mm
Weight	4.8 lbs; 2.2 kg (except D20E-K: 5.7 lbs or 2.6 kg)
Termination Facilities	Compression Terminal Block: 2.5 mm ² (#13 AWG) maximum

Communication ports

LAN Ports	Two 10/100Base-T LAN ports with unique MAC and IP address, each port has a switched connection (four RJ45)
Protocol	DNP3 TCP/IP with subset level 2 or IEC 61850 GGIO
Time Synchronization	NTP or DNP3
Time Mode	UTC or Local time
Local Indications	Link (green) and Activity (yellow) LEDs per RJ45 connector
LAN Conducted Immunity	As per: <ul style="list-style-type: none"> • IEEE C37.90.1 • IEC 61000-4-4 • IEC 61000-4-5 • IEC 61000-4-6 • IEC 61000-4-16
Console Port	USB 2.0 (micro AB jack): <ul style="list-style-type: none"> • Secure Shell (SSH)
Port Default IP Address	LAN 1 IP = 192.168.0.189 Port 22 LAN 2 IP = 192.168.1.189 Port 22 USB 2.0 IP = 10.0.0.1 Port 22

Testing and certification

Approvals

Approval	Applicable council directive ...	According to ...
CE compliance	Low voltage directive	EN 61010-1, EN 61010-2-030
	EMC Directive	EN61326-1
ISO	Manufactured under a registered quality program	ISO9001

Tests and Standards

Test	Reference Standard	Test Level
Dielectric voltage withstand	EN60255-5/IEC 60255-27	2.8 kV
Impulse voltage withstand	EN60255-5/IEC 60255-27	5 kV
Insulation resistance	IEC 60255-5/IEC 60255-27	500 VDC (test level)
Damped Oscillatory	IEC 60255-22-1	2.5 kV CM, 1 kV DM, 1 MHz
Electrostatic Discharge	EN61000-4-2/IEC 60255-22-2	Level 4
RF immunity	EN61000-4-3/IEC 60255-22-3	Level 3
Fast Transient Disturbance	EN61000-4-4/IEC 60255-22-4	Level 4
Surge Immunity	EN61000-4-5/IEC 60255-22-5	Level 3
Conducted RF Immunity	EN61000-4-6/IEC V 60255-22-6	Level 3
Power Frequency Immunity	IEC 61000-4-16	Level 4
Voltage interruption and Ripple DC	IEC 60255-11	PQT levels based on IEC 61000-4-29, and IEC 61000-4-17
Radiated and Conducted Emissions	CISPR11 /CISPR22/ IEC 60255-25	Class A
Sinusoidal Vibration	IEC 60255-21-1	Class 1
Power magnetic Immunity	IEC 61000-4-8	Level 5
Conducted RF Immunity 0 to 150 kHz	IEC 61000-4-16	Level 4 ^b
Ingress Protection	IEC 60529	IP30 front
Environmental (Cold)	IEC 60068-2-1	-40 °C
Environmental (Dry heat)	IEC 60068-2-2	+85 °C
Relative Humidity (Steady State)	IEC 60068-2-78	95% RH, +40 °C
EFT	IEEE/ANSI C37.90.1	4 kV, 5 kHz
Damped Oscillatory	IEEE/ANSI C37.90.1	2.5 kV, 1 MHz
Make and Carry	IEEE C37.90	4 A
Electrostatic Discharge (ESD)	IEEE/ANSI C37.90.3	8 kV CD/ 15 kV AD
Product Safety	IEC 61010-1	As per Normative sections

RoHS compliance



The Environmental protection use period (EPUP), as defined in PRC SJ/T11364-2014 for D20E product as listed in Table 3, can be recycled, and does not contain any hazardous substances and must be recycled.

The following hazardous substances are covered:

- Pb: Lead
- Hg: Mercury
- Cd: Cadmium
- Cr6: Hexavalent Chromium
- PBB: Polybrominated biphenyls
- PBDE: Polybrominated diphenyl ethers

Table 3: RoHS Material Declaration Data Content by Assembly

GE part number	Description	Pb	Hg	Cd	Cr6	PBB	PBDE
507-0501LF	D20E-S - Status Input Logic Main	0	0	0	0	0	0
508-0501LF	D20E-K - Control Logic Main	0	0	0	0	0	0
509-0501LF	D20E-C - Combination Logic Main	0	0	0	0	0	0
511-0501LF	D20E-A - DC Analog Logic Main	0	0	0	0	0	0
517-0501LF	D20E-A - CTB 5VDC AI LVPSU Interface	0	0	0	0	0	0
517-0502LF	D20E-A - DTB 5VDC AI LVPSU Interface	0	0	0	0	0	0
517-0503LF	D20E-K - CTB T/C LVPSU Interface	0	0	0	0	0	0
517-0504LF	D20E-K - DTB T/C LVPSU Interface	0	0	0	0	0	0
517-0505LF	D20E-K - DB25 T/C LVPSU Interface	0	0	0	0	0	0
517-0506LF	D20E-S - Standard Compression, 20 to 60 VDC LVDI, 20 to 60 VDC, 2X10/100 Base-T	0	0	0	0	0	0
517-0507LF	D20E-S - Standard Compression, 90 to 290 VDC HVDI, 20 to 60 VDC, 2X10/100 Base-T	0	0	0	0	0	0
517-0508LF	D20E-S - Compression disconnect, 20 to 60 VDC LVDI, 20 to 60 VDC, 2X10/100 Base-T	0	0	0	0	0	0
517-0509LF	D20E-S - Compression disconnect, 90 to 290 VDC HVDI, 20 to 60 VDC, 2X10/100 Base-T	0	0	0	0	0	0
517-0510LF	D20E-C - Standard Compression, Trip/Close, 5 V Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T	0	0	0	0	0	0
517-0511LF	D20E-C - Standard Compression, Trip/Close, 5V Analog Input, 90-290VDC HVDI, 20 to 60 VDC, 2x10/100 Base-T	0	0	0	0	0	0
517-0512LF	D20E-C - Compression disconnect, Trip/Close, 5 V Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T	0	0	0	0	0	0
517-0513LF	D20E-C - Standard Compression, Trip/Close, 5V Analog Input, 90 to 290 VDC HVDI, 20 to 60 VDC, 2x10/100 Base-T	0	0	0	0	0	0
517-0514LF	D20E-A - Standard Compression, 20 mA Analog Input, 20 to 60 VDC, 2x 10/100 Base-T	0	0	0	0	0	0
517-0515LF	D20E-C - Standard Compression, Trip/Close, 20 mA Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T	0	0	0	0	0	0
517-0516LF	D20E-C - Compression disconnect, Trip/Close, 20mA Analog Input, 20 to 60 VDC LVDI, 20 to 60 VDC, 2x10/100 Base-T	0	0	0	0	0	0

- O Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this item is below the limit required in GB/T 26572 and EU Directive 2011/95/EU (RoHS 2)
- X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this item is above the limit requirement in GB/T 26572 and EU Directive 2011/95/EU (RoHS 2)

The maximum concentration limits (MCV's) apply.

Lead (Pb)	0.1% by weight	=	1000 mg/kg	=	1000 ppm
Mercury (Hg)	0.1% by weight	=	1000 mg/kg	=	1000 ppm
Cadmium (Cd)	0.01% by weight	=	100 mg/kg	=	100 ppm
Chromium VI (Cr6)	0.1% by weight	=	1000 mg/kg	=	1000 ppm
PBB, PBDE	0.1% by weight	=	1000 mg/kg	=	1000 ppm

China RoHS 2 Statement

The D20E products are specifically designed for, and used as a products related to power generation, transmission and distribution equipment of electric energy. According to Article 3 (1) of "The Methods", power generation, transmission and distribution equipment of electric energy is excluded. The D20E products are therefore excluded from this scope.

Storage recommendations

Storage conditions

Always store the D20E 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



To avoid deterioration and early failure of electrolytic capacitors, power up units that are stored in a de-energized state once every 12 months, for one hour continuously.

D20E Ethernet I/O Module

Chapter 2: Installing the D20E Module

This chapter covers the following topics:

- [Required tools and materials](#) on page 35
- [Installation process](#) on page 36

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

Installation process

The tasks required to install a D20E module in a system are:

1. Configure the firmware; see chapter: [Configuring the D20E Firmware](#) on page 37.
2. Mount the D20E module in a 19" rack or cabinet; see chapter: [Mounting a D20E Module](#) on page 75.
3. Connect to devices and networks; see chapter: [Connecting to Devices and Networks](#) on page 77.
4. Power-up the D20E module and run the preliminary power up and test; see chapter: [Preliminary Power Up and Test](#) on page 83.
5. Connect the field wiring; see sections:
 - [D20E-A analog inputs module](#) on page 87
 - [D20E-K control outputs module](#) on page 89
 - [D20E-S digital inputs module](#) on page 95
 - [D20E-C combination inputs and outputs module](#) on page 97
6. Power-up the D20E module and verify that D20E module is functioning properly; see chapter: [Powering-up and Testing a D20E Module](#) on page 101.
7. Monitor D20E module operation; see chapter [Using the D20E Module](#) on page 103

D20E Ethernet I/O Module

Chapter 3: Configuring the D20E Firmware

This chapter describes the set up required to start operation of a D20E module. The D20E module is then ready to be configured and monitored, and ready for the download of projects files.

This chapter provides the following information:

- [Set up procedure](#) on page 37
- [Working with projects](#) on page 43
- [Configuring D20E modules](#) on page 49
- [Configuring points](#) on page 55
- [Digital input points](#) on page 55
 - [Counter points](#) on page 60
- [Analog input points](#) on page 63
- [Control output points](#) on page 69
- [Check operation of the D20E](#) on page 73
- [Make D20E device setting changes](#) on page 74

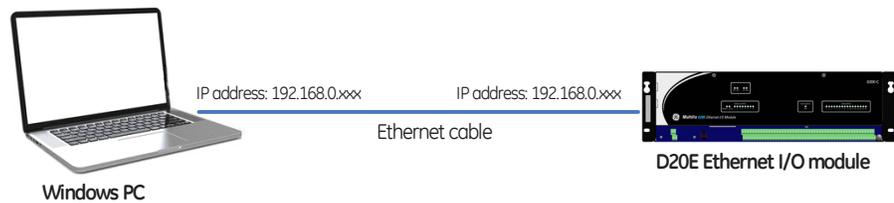
Set up procedure

To set up for the configuring, monitoring and downloading of projects to the D20E module, perform the following tasks:

1. Connect the D20E module (port 1) to a Windows PC with an Ethernet cable as shown in Figure 6.

A standard Ethernet cable can be used if connecting to a network with an Ethernet switch.

Figure 6: Windows PC to D20E connection



The PC must be running Windows 7 or later and must be Ethernet capable with an IP address in the 192.168.0.xxx range with a subnet of 255.255.255.0.

The D20E module default IP address is 192.168.0.189.

2. Install the DAPserver Studio on the Windows PC; see section [DAPserver Studio installation](#) on page 38.

DAPserver Studio installation

DAPserver Studio is a multi-device:

- Configuration tool, and
- Online monitoring tool.

To install the DAPserver Studio suite:

1. Insert the DAPserver Studio DVD into the PC or run the **DAPserverStudioSetup.exe** file. If AutoRun is disabled, open the DVD using Windows Explorer and double-click **AutoRun.exe**. When the dashboard opens, click on **Install DAPserver Studio**.

Result: The DAPserver Studio opens.



2. Select the **I agree to the license terms and conditions** check-box.
3. Click **Next**.
Result: The Create Application Shortcuts window appears.
4. Select either a **Typical** or **Custom** setup type.

5. Select the check-box for each shortcut you prefer:
 - **Desktop**
 - **Start Menu Programs folder**
 - **Startup folder**
6. Click **Install**.
Result: The Microsoft Visual C++ license window appears.
7. Install Microsoft Visual C++:
 - 7.1. Select the **I agree to the license terms and conditions** check-box.
 - 7.2. Click **Install**.
Result: The Microsoft Visual C++ window - Setup Successful message appears.
 - 7.3. Click **Close**.
Result: The Microsoft Visual C++ window closes.
Result: The Setup wizard appears.
8. Run the Setup wizard.
 - 8.1. Click **Next**.
Result: The Setup wizard - Destination Folder pane appears.
 - 8.2. Click **Next**.
Result: The Setup wizard - Ready to Install pane appears.
 - 8.3. Click **Install**.
Result: The tools are installed in the specified location.
Result: The Setup wizard - Completed pane appears.
Result: A DAPserver Studio status (progress) bar appears.
Result: The message appears: DAPserver Studio has been successfully installed.
9. Click **Finish**.

Start DAPserver Studio

DAPserver Studio is used to access and configure the D20E module. For further information on DAPserver Studio, refer to appendix: [DAPserver Studio](#) on page 125.

To start DAPserver Studio:

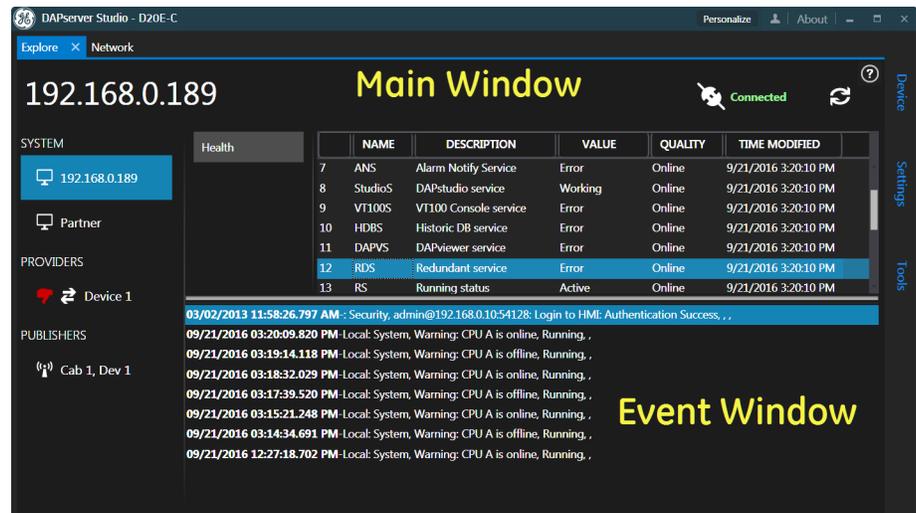
1. Double-click on the DAPserver Studio desktop icon.
If the icon does not appear on the desktop, navigate to Windows **Start > All Programs > DAPserver Studio** and click on the DAPserver Studio icon.
Result: The Start screen appears.
2. Create a **New** D20E project or select a D20E project from **My Devices** ore the **Recent** list.
3. On the right side of the screen select **Device > Explore**.

Result: The Device Information window appears.

4. Type in the actual **IP Address** of the D20E module.
5. Type in the **Username** and **Password** login credentials (default: **admin**).
6. Click **OK**.
Result: The upper-right LAN connection icon should show Connected in green.
7. Ensure that the:
 - PC Ethernet port used to communicate with D20E module is configured to be on the same subnet as the D20E module.
 - The IP address configured in DAPserver Studio must match the IP address in the D20E module for a successful connection. The default IP addresses for DAPserver Studio projects and the D20E module LAN 1 are 192.168.0.189.

Result: For example, the Explore window can appear as shown in Figure 7.

Figure 7: Explore window - Main window and Event window



The Explore window has two main areas:

- Main window, and
- Event Window.

You can navigate the Main Window by selecting the options in the left pane, while also being able to monitor the D20E module using the Event Window.

Change D20E module IP address

The D20E module is delivered with the default IP address: 192.168.0.189.

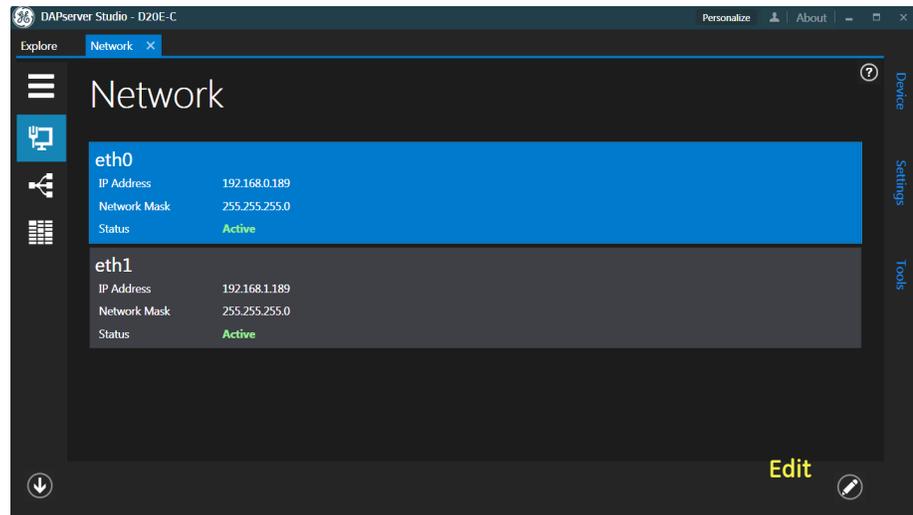
To change the IP address of the D20E module:

1. Navigate to the **Device** menu bar.
2. Select **Network**.
Result: The Device Information window appears.
3. Type in the **IP Address** of the D20E module.
4. Type in the **Username** and **Password** login credentials (default: **admin**).

5. Click **OK**.

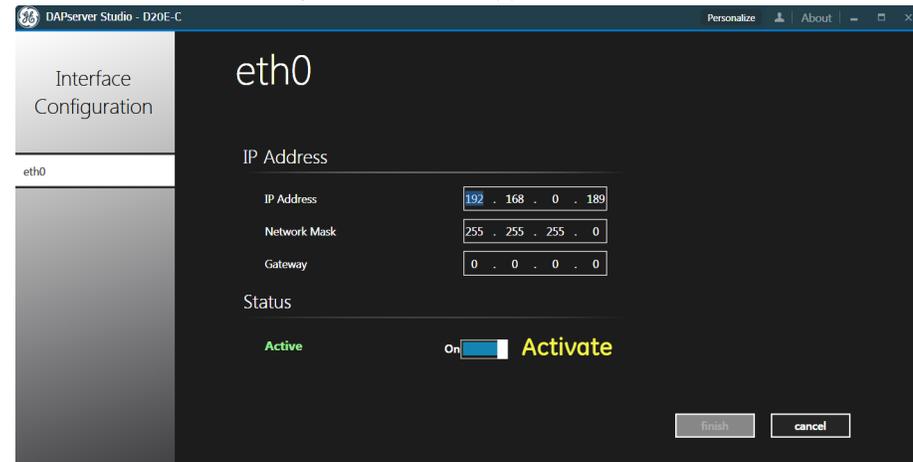
Result: The Network window appears as shown in Figure 8.

Figure 8: Network window



6. Select the Ethernet port you want to change by either:
 - Double-clicking the respected Ethernet box, or
 - Single-clicking the respected Ethernet box (highlighting the box) and clicking **Edit**.

Result: The Network - Configuration window appears.



7. Type in the new **IP Address** and **Network Mask**.
8. Ensure that Status > Active is set to **On**.
9. Click **Finish**.
10. Right-click a blank area of the screen.
Result: The Task bar appears at the bottom of the screen.
11. Click **Sync** in the Task bar.
Result: DAPserver Studio updates the D20E module with the new IP address and restarts the device.

12. Connect to the new IP address after the D20E module has restarted.



If the D20E IP address was changed to a different subnet, the PC Ethernet port must also be changed to that subnet.

Any D20E IP Address, independent from the open DAPserver Studio project, can be changed with this process. Just enter the IP Address of the D20E that you want to change in Step step 3.

DAPserver Studio sync project

The D20E module is delivered with a factory-default project installed on it.

To change a running project configuration or install a new project configuration:

1. Navigate to the **Settings** menu bar.

2. Click **Sync**.

Result: The Device Information window appears.

3. Type in the **IP Address** of the D20E module.

4. Type in the Username **admin** and Password **admin** login credentials (default).

5. Click **OK**.

Result: DAPserver Studio performs the Sync process and then restarts the D20E module.

6. Select **Device > Explore** to connect to the D20E module after is has restarted.



The DAPserver Studio version should match the firmware on the D20E module. If the D20E is running a firmware version that is older than the DAPserver Studio software version, DAPserver Studio may not connect (communicate) with the older D20E firmware device. However, most older firmware versions on the D20E will connect to the latest DAPserver Studio.

Working with projects

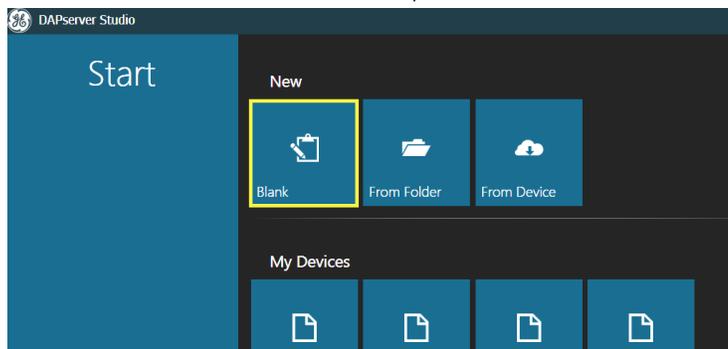
When working with projects, you can:

- Create a new project; see subsection: [Create a project](#) on page 44
- Open an existing project; see subsection: [Open a project](#) on page 47
- Import an existing project from a:
 - Folder; see subsection: [Import an existing project from a folder](#) on page 47
 - Device (upload existing project configuration from D20E); see subsection: [Import an existing project from a device](#) on page 48
- Save a project; see subsection: [Save a project](#) on page 48
- Delete a project; see subsection: [Delete a project](#) on page 49

Create a project

To create a project:

1. Open DAPserver Studio.
2. Click the New > **Blank** box on the main pane.



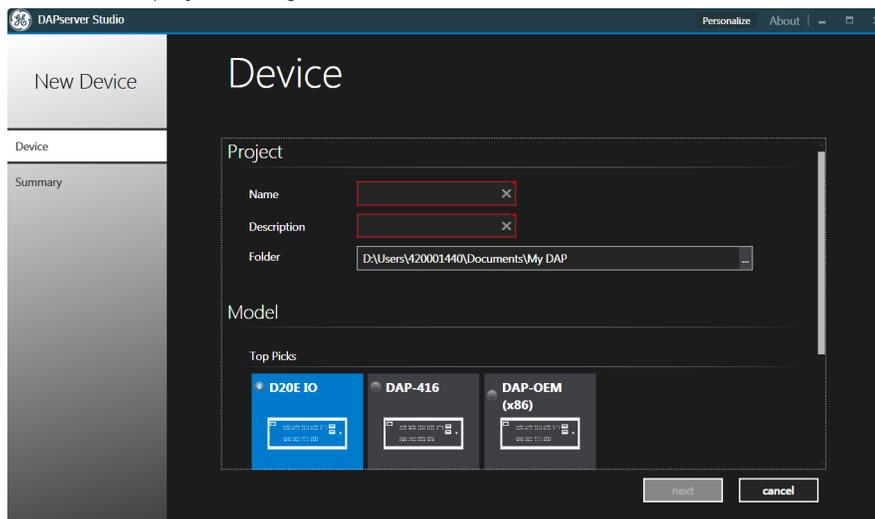
Result: The Device window appears.

NOTICE

A D20E project must be created from a blank template.

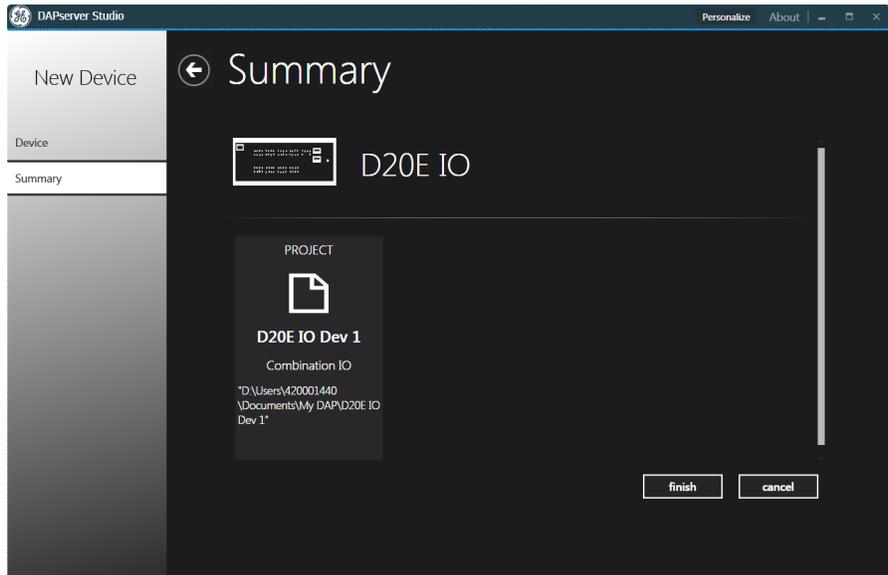
If your D20E is to be connected to a GE Grid Solutions D20, D20MX, D400, or DMC490 device, only use the device template files provided on the D20E Doc CD. Do not use the device template files available on **DAPserver Studio**.

3. Type in the Project **Name** and **Description**.
4. Click the ... (browse) button to the right of the **Folder** field. Create the folder that is to store the new project configuration.

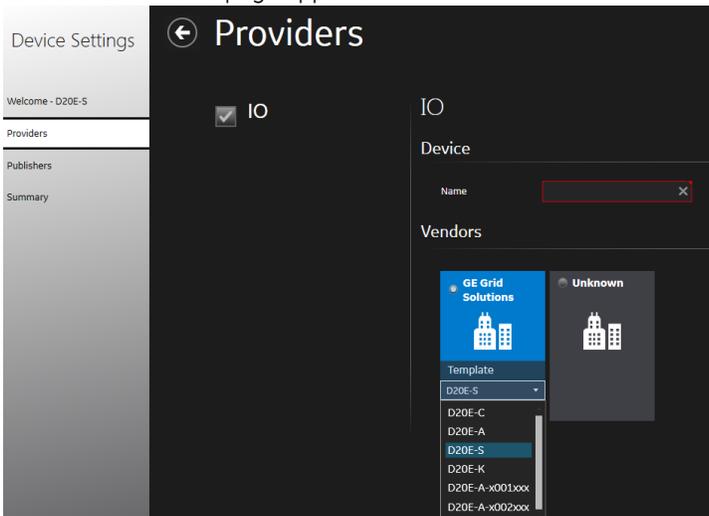


Each project must be stored in a unique folder which can be created from this screen. The Main Project Folder created at the beginning of this guide is intended to hold each of these folders, but is not required.

- Click **Next** to continue the configuration of the new project.
Result: The Summary page appears showing the project details.



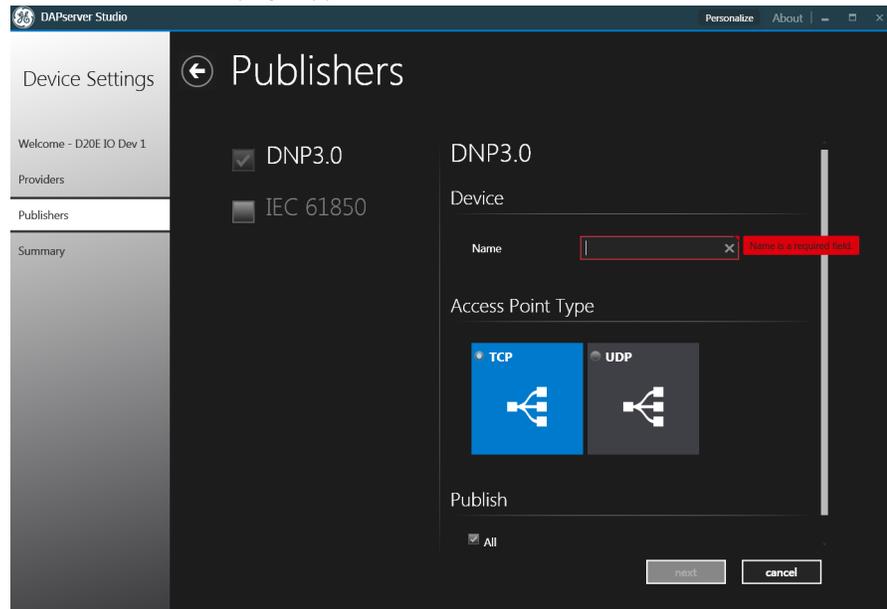
- Click **Finish**. Result: The Welcome page appears.
- Click **Next**.
Result: The Providers page appears.



- Select the D20E IO module model.
Select the D20E IO model from the drop-down list tab. Selecting the correct hardware part number will auto configure the IO Provider with scaling, controls and alarm values. The default projects vary for the D20E-A, K and C models; accordingly, a specific project is available for each model. All D20E-S board variations share a single default project.

9. Click **Next**.

Result: The Publishers page appears.



NOTICE

Only one Publisher (either DNP or IEC61850) may be configured for the D20E. In order to change the Publisher protocol, you must create a new blank project.

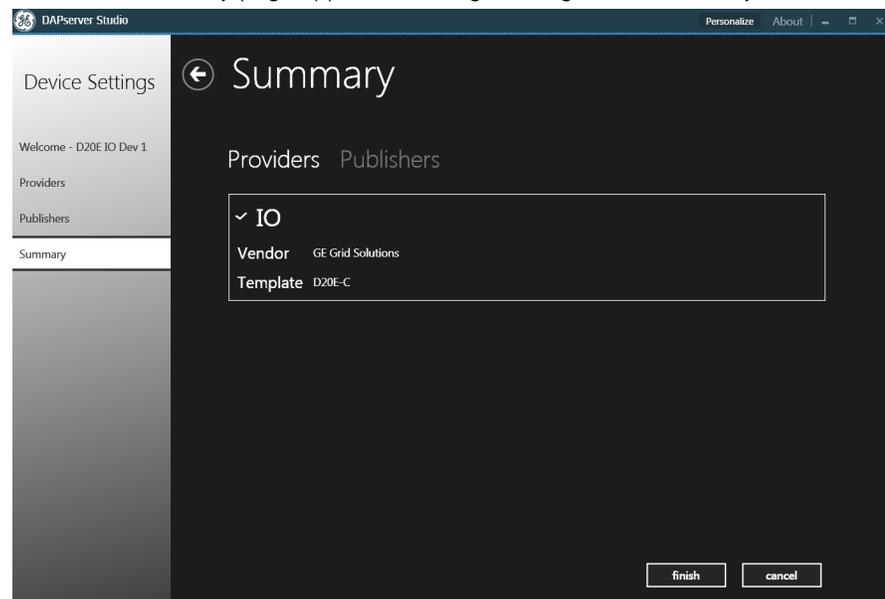
10. Select the check-box for the protocol you wish to add to the D20E (DAP IO):
 - **DNP 3.0**
 - **IEC 61850**

NOTICE

The D20E 61850 Provider must have GOOSE enabled. If there is no GOOSE configured in the SCL model, DAPserver Studio will not import the model.

11. Click **Next**.

Result: The Summary page appears showing a configuration summary.

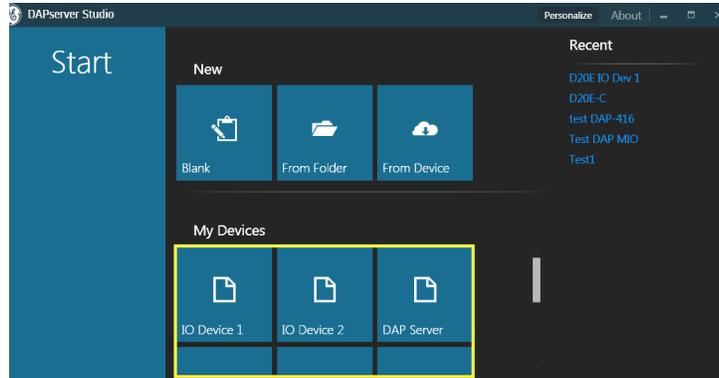


12. Click **Finish**.

Open a project

To open a project:

1. Open DAPserver Studio.
2. Double-click an existing project from the My Devices section of the DAPserver Studio main window.

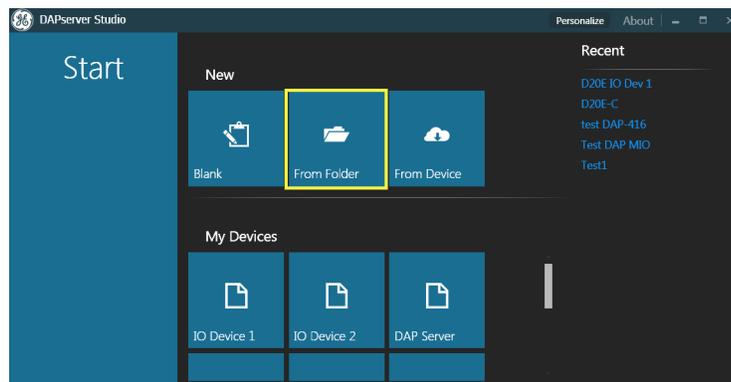


Result: The project opens.

Import an existing project from a folder

To import an existing project file from a folder:

1. Open DAPserver Studio.
2. Click the **From Folder** box.



3. Navigate to the project folder for the project configuration that is to be imported.

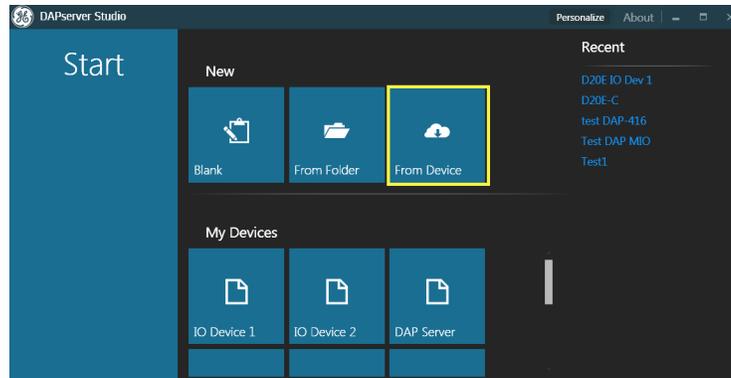
Import an existing project from a device



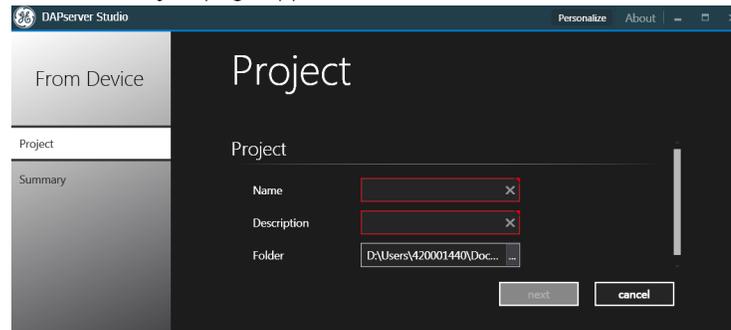
The DAPserver Studio version should match the firmware on the D20E module. If the D20E is running a firmware version that is older than the DAPserver Studio software version, DAPserver Studio may not connect (communicate) with the older D20E firmware device. However, most older firmware versions on the D20E will connect to the latest DAPserver Studio.

To import an existing project file from a device:

1. Open DAPserver Studio.
2. Click the **From Device** box.



3. Result: The Project page appears.



4. Type in the project **Name** and **Description**.
5. Select an empty **Folder** to store the project configuration.
6. Type in the **IP Address** of the D20E (DAP IO).
7. Type in the **Username** and **Password**.
8. Click **OK**.

Save a project

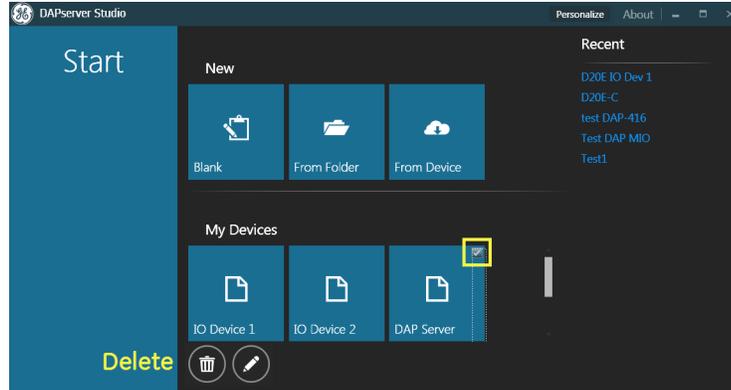
To save a project configuration after modifications have been made:

1. Open the **Settings** menu bar.
2. Click **Save**.

Delete a project

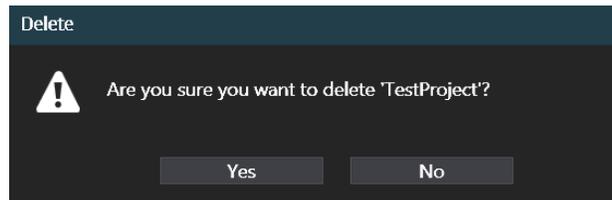
To delete a project:

1. Open DAPserver Studio.
2. Hover on an existing project from the My Devices section of the DAPserver Studio main window and select the check-box.



3. Confirm that the project you wish to delete is selected. (that is, a check-mark appears in the top-right of the device box).
4. Click **Delete** (trash can).

Result: A message window appears asking if you would like to delete the project you have selected.



5. Click **Yes**.

Result: The project is removed from DAPserver Studio.

Configuring D20E modules

This section describes how to configure D20E modules. This comprises how to:

- [Configure NTP time sync](#) on page 50
- [Change an existing user's password](#) on page 51
- [Change an existing user's permissions](#) on page 53

For detailed information on configuring the point types, see section [Configuring points](#) on page 55.

Configure NTP time sync



NOTE

Ensure that the Time Zone of the DAPserver Studio™ and the Time Zone of the Windows PC are the same before performing the following procedure.



NOTE

NTP server is not to be used as a time source.



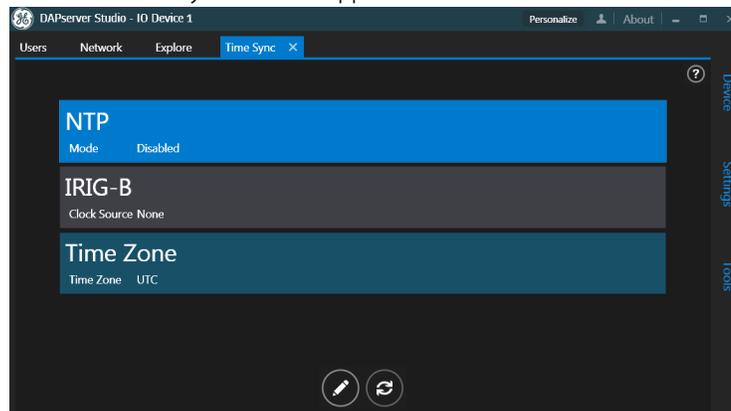
NOTE

Only one source of time sync is permitted on the D20E modules. The Client NTP time sync should be used by the D20E module, and DO NOT use both DNP and NTP time sync simultaneously.

To time synchronize a D20E module with an NTP time source:

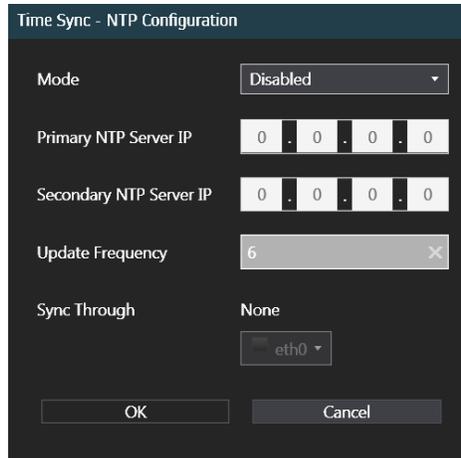
1. Power up the D20E module.
2. Connect the D20E module to DAPserver Studio via the LAN port.
3. Run the DAPserver Studio.
4. Select **Time Sync** from the **Device** menu.
Result: The NTP configuration window appears.
5. Type in the **IP Address** of the D20E module.
6. Type in the **Username** and **Password** login credentials.

Result: The Time Sync window appears.



7. Select the NTP configuration by either:
 - Double-clicking on the NTP configuration box or
 - Clicking NTP, right-clicking a blank area of the window, and then clicking **Edit** at the bottom of the page.

Result: The Time Sync - NTP Configuration window appears.



8. From the **Mode** menu, select **Client**.
The D20E device only supports the NTP Client.
9. Type in the **Primary NTP Server IP** addresses and the **Secondary NTP Server IP** addresses.
10. Change the **Update Frequency**, if necessary.



Update Frequency is used for legacy devices. Not supported/used by D20E modules.

11. Click **OK**.
Result: The Time Sync - NTP Configuration window closes.
Result: The changes are saved.
12. Click the **Sync** icon at the bottom of the Time Sync page.
Result: The DAPserver Studio downloads the new NTP settings to the D20E module.
Result: A screen appears, indicating that the sync was successful for the Primary NTP Server IP.
13. [Optional] Access the D20E device console (through the USB connector) and set the D20E clock so that the actual NTP server time sync will be closer on first initial adjustment, reducing initial error and accelerating time sync convergence:
 - 13.1. Run the terminal emulator.
 - 13.2. Logon to the D20E module console mode.
 - 13.3. Change the time and date to be synchronized with the NTP server after the configured update period.

For information on setting the clock, see section: [Clock setting](#) on page 118.

Change an existing user's password

The default User names and Passwords are

Username	Password
admin	admin
root	root

It is recommended that users be assigned a custom Username, or a custom admin Password. The root password provides limited DAPserver Studio access.

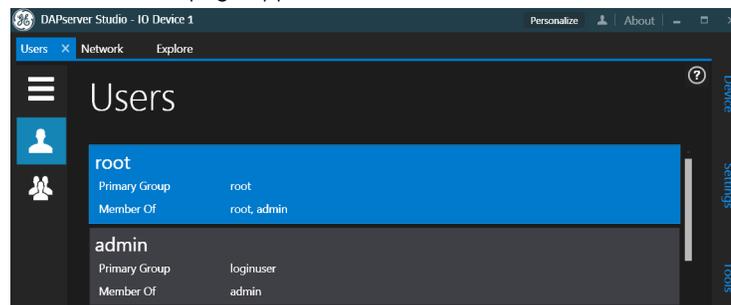
NOTICE

It is the responsibility of the customer to change these default passwords. If a customer loses the password, the D20E module will need to be returned to GE Grid Solutions to be re-imaged in order to regain access.

To change an existing user's password using DAPserver Studio:

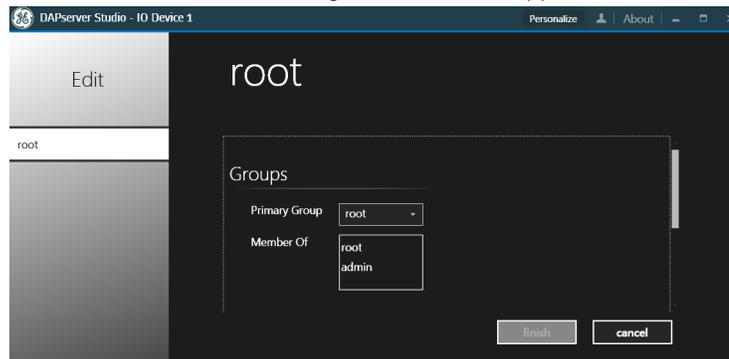
1. Open the **Device** menu bar.
2. Click **Users**.
Result: The Device Information window appears.
3. Type in the **IP Address** of the D20E module.
4. Type in the **Username** and **Password** login credentials (default: **admin**).
5. Click **OK**.

Result: The Users page appears.



6. Select the user which is to have the password changed by either:
 - Double-clicking the user, or
 - Clicking the user, right-clicking a blank area of the window, and then clicking **Edit** at the bottom of the page.

Result: The Users - "root" Configuration window appears.



7. Enter the new password into the **Password** and **Confirm Password** fields.
8. Click **OK**.
Result: The Users - "root" Configuration window closes.
9. Click the **Sync** icon at the bottom of the Users page.

Result: The password change is finalized.

Result: All changes do not log out impacted users. The password changes take effect only when a user attempts to connect after the change is synchronized.

Change an existing user's permissions

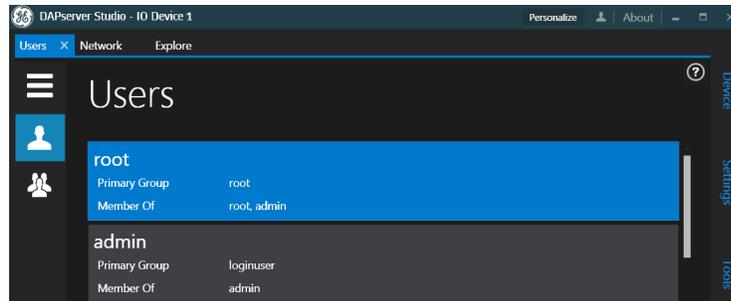
To change an existing user's permissions using DAPserver Studio follow this example:

1. Open the **Device** menu bar.
2. Click **Users**.

Result: The Device Information window appears.

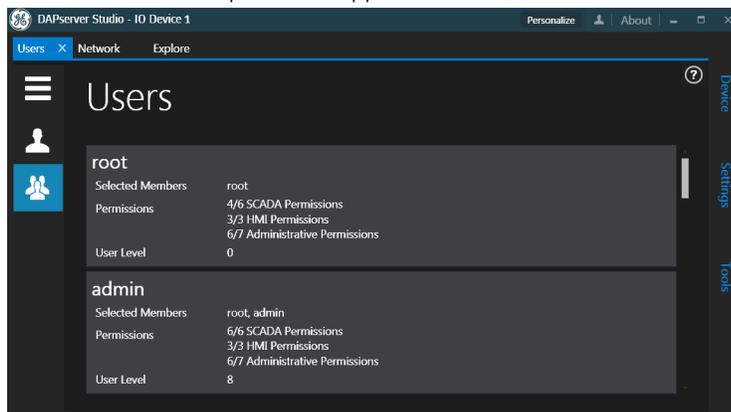
3. Type in the **IP Address** of the D20E module.
4. Type in the **Username** and **Password** login credentials.
5. Click **OK**.

Result: The Users page appears.



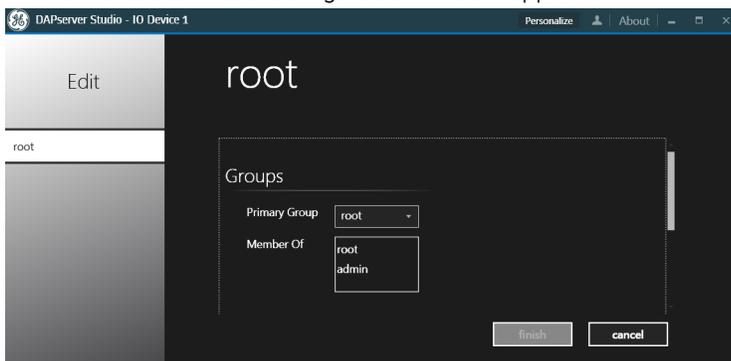
6. Click the **Groups** icon in the left menu.

Result: The User Group window appears.



7. Select the user which is to have the password changed by either:
 - Double-clicking the user, or
 - Clicking the user, right-clicking a blank area of the window, and then clicking **Edit** at the bottom of the page.

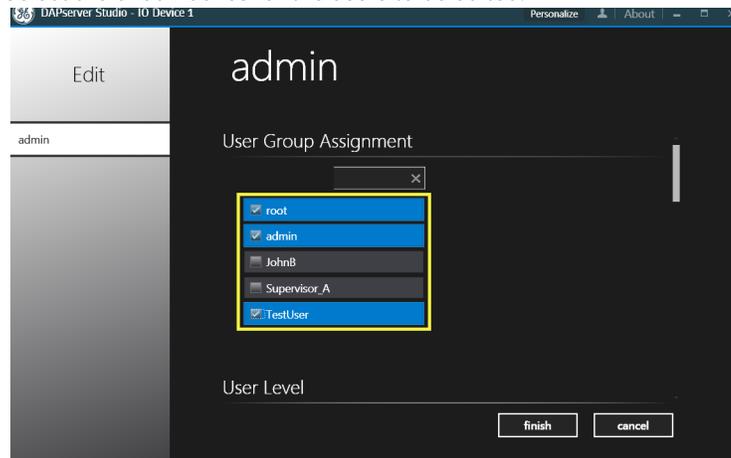
Result: The Users - "root" Configuration window appears.



8. Select the User Group which contains the User by either:
 - Double-clicking the User Group, or
 - Clicking the User Group, right-clicking a blank area of the window, and then clicking **Edit** at the bottom of the page.

Result: The User Group window appears.

9. Select the check-boxes for the users to be edited.

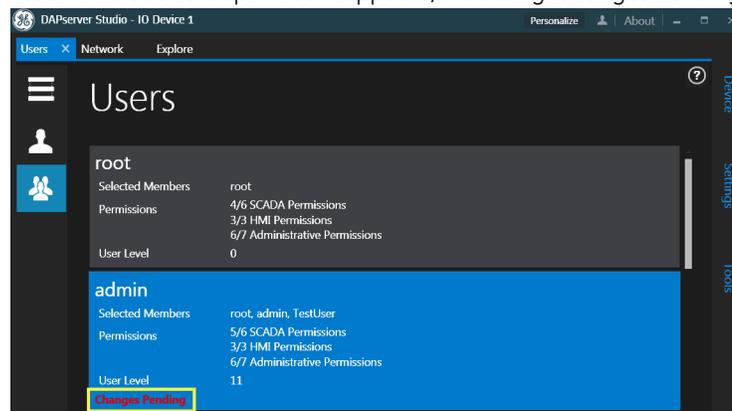


10. Scroll down and adjust the slider for the desired **User Level**.
11. Scroll down and select check-boxes for the relevant Permissions associated with the D20E:
 - SCADA Operations
 - Administrative Operations

See the DAPserver Studio User Manual, Get Help guide for further descriptions listed under SCADA Operations and Administrative Operations for user group permissions.

12. Click **Finish**.

Result: The User Group window appears, indicating: Changes Pending.



13. Right-click a blank area of the screen.

Result: The Task bar appears at the bottom of the screen.
14. Click **Sync** in the Task bar.

Result: The Change Pending message is cleared.

Configuring points

The following sections provide details for configuring the D20E firmware with the following point types:

- [Digital input points](#) on page 55
 - [Counter points](#) on page 60
- [Analog input points](#) on page 63
- [Control output points](#) on page 69

The DAPserver Studio tool is used to configure the D20E modules. Most of the configuration information provided in this chapter is associated with the DAPserver Studio **Settings > Provider** tab.

Digital input points

The D20E-S module allows up to 64 status input connections and the D20E-C module allows up to 16 digital inputs.

Single and double digital input

There are up to 64 status inputs that can be configured as:

- Single point status (see Table 4) or
- Double point status (see Table 5).

When a status input is configured as a double point, each point occupies two input spaces on termination block TB2; for example, on the D20E-S, TB2-1 and TB2-67 represent DI#1 LSB state; and TB2-2 and TB2-68 represent DI#1 MSB state. When mapping the double point into DAP server, you only map the LSB.

Table 4: Single Input States:

State	Input
Off/Open	0
On/Close	1

Table 5: Double Input States:

State	Input	
Off/Open	0	1
Transition	0	0
On/Close	1	0
Invalid	1	1



NOTE

The D20MX Substation Controller does not support double Digital Input from the D20E IO Module.

COS and SOE

The digital input state change report can be set to report:

- With a time tag (SOE mode) or
- Without time tag (COS mode).

In SOE mode, point state changes are marked with a time tag from the local device; this time tag is then passed to the mapped server (e.g., DNP3) message accordingly.

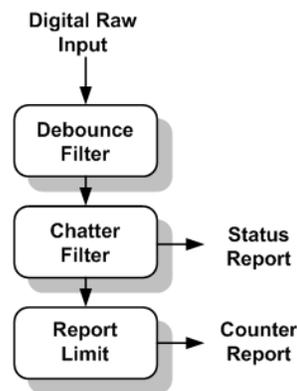
Two Level Filtering

The D20E module uses two-level filtering to ensure that digital input reporting is stable:

- The first level of filtering is performed by the Debounce Filter and
- The second level of filtering is performed by a Chatter Filter.

In order to successfully report a digital status change, the input signal must pass through both filters. See the Debounce and Chatter Filter process in Figure 9.

Figure 9: Debounce and chatter filter process



Debounce filter period

The debounce filter period is the length of time that a digital input value has to be set stable before the application reports the actual state change. The filter time eliminates debounces and short disturbances on a digital input. The filter time is set individually for each digital input point.

Chatter filter (oscillation suppression)

The oscillation suppression is used to block point changes and alarms for the overall system if a digital input starts oscillating. A digital input is regarded as oscillating if the number of valid status changes during a 1 second period is greater than the set value of the input oscillation (On Trigger); if oscillating, the digital input is blocked (status is invalid) and an events alarm is generated. The state of the input does not change when the point is blocked and the point's state depends on the condition before blocking.

The digital input is regarded as non-oscillating if the number of valid status changes during a period of time (e.g., one second) is less than the set recovery value of the input oscillation level (Off Hysteresis). When the input returns to a non-oscillating state, the digital input is deblocked (status is valid) and events can be reported.



NOTE

The oscillation recovery (Off Hysteresis) must be set lower than the oscillation On Trigger level to enable the input to be restored from oscillation.

Digital input status change report as counter value

All digital input status changes can be reported as a counter value. When a digital input point is configured as a counter point type, the point should be removed from digital input table and added into the counter point configuration table. See section [Counter points](#) on page 60 for details.

Digital input point quality flag

A Digital input includes the quality flags listed in Table 6.

Table 6: Digital input quality flags

Quality flag	Description
On-line:	Indicates an input's online/offline state;
Restart:	Indicates if the device (point) has restarted, but has not been initialized yet.
Communication Lost:	This bit is set when this point is off-line,
Remote Forced:	This bit is set when the point is remote forced;
Local Forced:	This bit is set when the point is locally forced.
Chatter Filer:	This bit is set when the chatter file is active for this point.

Digital input configuration settings

Table 10 lists the Digital Input configuration settings and recommended setting values.

Table 7: Digital input points configuration settings

Setting	Descriptions	Range	Default
General settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Bay Name	Specify the name of the bay to which the digital input belongs.		
Group Name	Specify a unique name used in conjunction with the below Point Description setting when referencing the Provider Application Digital Point information. The Group Name is used by the HMI for trending and event querying; therefore, using a label associated with the substation topology is recommended.	0 to 64 characters	
Point Name	Specify the name of the point. The Point Name should be unique within the bay and group to which it belongs. Note: IEC61850 point names should not be changed since the point name is the IEC address, and that would prevent upstream reporting to the substation server.		
Point Description	Specify a descriptive label for the digital input. This setting is used in the HMI Application Point Status Viewer and Event Recorder.	0 to 128 characters	
Value Type	Specify the data type the Provider application uses when storing the digital input in the database.	Single Double	Single
Initial Value	During initialization, the digital input is set in the database to the value specified in this setting. When connecting to a D20MX Substation Controller, Open is OFF and Closed is ON.	Open Close	Open
Class	Specify the class to which the digital input belongs.	Alarm Fault Status Information	

Setting	Descriptions	Range	Default
Value (0) Name	Specify the name of this digital input when it has a value of 0. The name can be entered manually, or double-click this field and select from the menu. This setting is only applicable for double digital input points.		
Open Name	Specify the name displayed when this DI is in the open state: <ul style="list-style-type: none"> Single Point Digital Input - Open state = 0 Double Point Digital Input - Open state = 1 The name can be entered manually, or double-click and select from the menu. This name appears in this application's user interface and HMI. It is also recorded in the Historic Database.		
Close Name	Specify the name displayed when this DI is in the close state: <ul style="list-style-type: none"> Single Point Digital Input - Close state = 0 Double Point Digital Input - Close state = 1 The name can be entered manually, or double-click and select from the menu. This name appears in this application's user interface and HMI. It is also recorded in the Historic Database.		
Value (3) Name	Specify the name of this digital input when it has a value of 3. The name can be entered manually, or double-click and select from the menu. Value (3) Name is only applicable for double digital input points.		
Historical settings			
Note: The D20E does not currently support the Historical data settings.			
Event settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
COS Event	Specify when a change-of-state event is generated for this digital input pseudo point.	Disable Off State Only One State Only On and Off State	Disable
Control settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Open DO Point	Specify a DO point which is to trip (i.e., turn off) this DI when a control is applied to this point.		
Close DO Point	Specify a DO point which is to close (i.e., turn on) this DI when a control is applied to this point.		
Providers - Protocol settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Physical Index	Specify the index of the physical IO pin.		
Debounce Filter Length	Specify (in ms) the amount of time a point must stay in a given state before a change to state is recorded.	0 (off) to 1000.ms	
Chatter Filter Time Range	Select the amount of time (in ms) to be used in the Chatter Filter calculation.	100 ms 1000 ms	
Chatter Filter On Trigger	Specify the number of changes during the Chatter Filter Time period that enables the Chatter Filter. The recommended value is 10 to 20 changes, to reduce event noise.		0

Setting	Descriptions	Range	Default
Chatter Filter Off Hysteresis	Specify the number of changes allowed during the Chatter Filter Time period before the Chatter Filter is turned off.	0 (off) to 900 changes	
Pulse Count Enable	This setting must be disabled for Digital Input points.		
Pulse Count Reset	Not used with Digital Inputs.		
Pulse Polarity	Not used with Digital Inputs.		
Physical Index 2	Specify the second physical IO pin. This setting is only used for Dual Digital Status points. This setting is not used for Single Status points.		
Publisher settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Point Description	Specify the point description of the mapped digital input.		
Value Type	Specify the data type the Publisher application uses when reporting the digital input.	Single point Double point	
RTDB Point	Specify the RTDB point whose value is reported for the digital input. A custom window allows you to associate the digital input to any digital input available in the D20E.		

Double digital input configuration procedure

If you are configuring a D20E-S module, you need to convert 64 single Digital Input points to 32 double Digital Input points.

If you are configuring a D20E-C module, you need to convert 16 single Digital Input points to 8 double Digital Input points.

For example, to configure double DI points on a D20E-S module:

1. Navigate to the **Provider > IED** section.
 - 1.1. Delete the last 32 points under **Provider > IED > Digital Input > General**.
 - 1.2. Change the value type to **Double DI**.
 - 1.3. Change the **Value Type** setting for the first 32 points to **Double Point**.
2. Navigate to **Provider > IED > Digital Input > Protocol**
 - 2.1. Change the **Physical Index** setting for the double DI (start from 1,3,5,...).
 - 2.2. Change the **Physical Index 2** setting for the double DI (start from 2,4,6,...).
3. Navigate to the **Publisher > View > Digital Input > General** section:
 - 3.1. Delete the last 32 points.
 - 3.2. Change the value type to **Double DI**.
 - 3.3. Change the **Value Type** setting for the first 32 points to **Double Point**.

NOTICE

Multiple inputs mapped to the same physical index may cause these points to appear off-line and not be reported. The Inspect tool does identify conflicts under **Physical Index 2**.

Counter points

The Digital Input points in the D20E-S and D20E-C modules can be configured as counter type points. When a digital input is configured as a counter point, each digital status change event is accumulated and reported as a counter value.

Configure counter points

A Digital Input and a Counter cannot be assigned to the same contact.

To configure a counter point:

1. Remove a Digital Input from the point list.
2. Add the Counter to the point list.



If a Digital Input and Counter are configured to share the same contact, an error message appears and a sync with the D20E is not allowed.

Counter type

A Digital Input point can be configured with the counter types listed in Table 8.

Table 8: Counter type descriptions

Counter type	Description
Binary	Single input counter that accumulates a specified polarity transition or state change.
Binary Frozen	Binary counter in conjunction with a protocol freeze command.
Form C	This is a two-input counter, the same as a standard KYZ counter. When any complimentary state change occurs simultaneously on the two inputs, the counter increases in value on the specified high or low polarity transition.
Form C Frozen	Form C counter in conjunction with a protocol freeze command.
Dual Point	This is a two-input switch or breaker operation counter. See figure for functionality.
Dual Point Frozen	DP counter in conjunction with a protocol freeze command.

Dual point counter

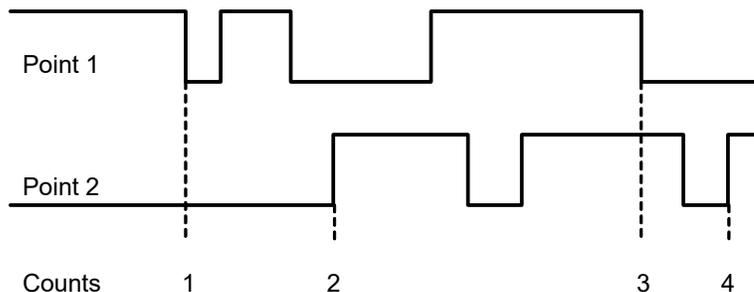
The states of a dual point counter are listed in Table 9.

Table 9: Dual point counter - states

Number of possible indicator states	State of point 1	State of point 2
1	1	0
2	0	1
3	1	1
4	0	0

Figure 10 shows the indicator states triggered by Point 1 and Point 2. The first transition is from Point 1, then the opposite transition from Point 2, and so on.

Figure 10: Dual point counter - state changes



Counter value type

The counter value is always an unsigned integer without an Over Range bit. When a counter value reaches the maximum value, the counter rolls over counting from 0, 1, 2 and so on.

Counter point quality flag

A Counter point includes the quality flags listed in Table 10.

Table 10: Counter point quality flags

Quality bit	Description
On-line	Indicates an input's online/offline state.
Restart	Indicates if the device (point) has restarted, but has not been initialized yet.
Communication Lost	This bit is set when this point is off-line.
Remote Forced Data	This bit is set when the point value is remotely forced.
Local Forced Data	This bit is set when the point value is locally forced.
Roll-over	This bit is set when a roll-over counting occurred.
Reference Check	This bit is set when the analog input reference is not set (may not be needed).

Counter point configuration settings

Table 11 lists the Counter Point configuration settings and recommended setting values:

Table 11: Counter points configuration settings

Setting	Descriptions	Range	Default
General settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Bay Name	Specify the name of the bay to which the digital input belongs.		
Group Name	Specify a unique name used in conjunction with the below Point Description setting when referencing the Provider Application Counter Point information. The Group Name is used by the HMI for trending and event querying; therefore, using a label associated with the substation topology is recommended.	0 to 64 characters	
Point Name	Specify the name of the point. The Point Name should be unique within the bay and group to which it belongs.		
Point Description	Specify a descriptive label for the digital input. This setting is used in the HMI Application Point Status Viewer and Event Recorder.	0 to 128 characters	
Value Type	Specify the data type the Provider application uses when storing the counter in the database.	Invalid Signed or Unsigned Integer Signed Long Integer Short (32-bit IEEE format) Floating Double (64-bit IEEE format) Floating	
Initial Value	Specify the initial counter value that appears in the database during initialization.		

Setting	Descriptions	Range	Default
Historical settings			
Note: The D20E does not currently support the Historical data settings.			
Calculation settings			
Note: No calculation is applied on the Counter Input.			
Providers - Protocol settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Physical Index	Specify the index of the physical IO pin.		
Debounce Filter Length	Specify (in ms) the amount of time a point must stay in a given state before a change to state is recorded.	0 (off) to 1000.ms	
Chatter Filter Time Range	Select the amount of time (in ms) to be used in the Chatter Filter calculation.	100 ms 1000 ms	
Chatter Filter On Trigger	Specify the number of changes during the Chatter Filter Time period that enables the Chatter Filter. The recommended value is 10 to 20 changes, to reduce event noise.		0
Chatter Filter Off Hysteresis	Specify the number of changes allowed during the Chatter Filter Time period before the Chatter Filter is turned off.	0 (off) to 900 changes	
Pulse Count Enable	This setting must be enabled for Counter points.		
Pulse Count Reset	Specify the Reset Pulse count to be value 0 (zero) when the D20E is rebooted and when the Pulse Count Enable setting is Enabled.		
Pulse Polarity	Specify the state that increases the count of the Counter point.	High Low	
Physical Index 2	This setting is not used for Counter points.		
Counter Type	Specify the type of counter. See section: Counter type on page 60. Note: Only Binary counters should be selected. This enables both Binary and Frozen counter types in the Publisher for DNP3.0 Object 21 and integrity polls.		
Publisher settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Point Description	Specify the point description of the mapped analog input or counter.		
Value Type	Specify the data type the Publisher application uses when reporting the counter.	Discrete Signed integer Unsigned integer Long Signed integer Floating (Short 32-bit IEEE format) Double (Floating 64-bit IEEE format)	
RTDB Point	Specify the RTDB point whose value is reported for the counter. A custom window allows you to associate the counter to any analog input or counter available in the D20E.		

Analog input points

The D20E-A module allows up to 32 analog inputs and the D20E-C allows up to 16 analog inputs.

Analog value type

The D20E-A analog input can be set from 1 to 20 mA current or from 5 V differential voltage input. All input can be scaled with a full range of Short or Long Floating; and Signed or Unsigned Integer (16-bit or 32-bit).

When an input value exceeds the maximum range, the analog input appears with the maximum value and an Over Range flag is set on the point quality.

Analog report deadband

Specify the size of change between the new value of an analog input and the previous value before the application reports the new value to the system point database. Use this option to control the number of data change-of-events generated for an analog input. The default value is zero; that is, the deadband function is disabled, and the device reports all changes.

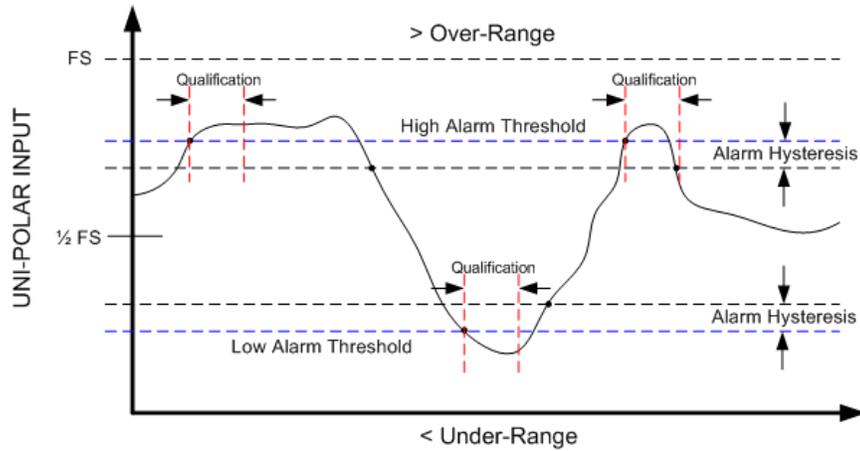
Analog alarm threshold, hysteresis and qualification period

Each Analog Input point can generate an alarm while the input is under an abnormal condition. The alarms are configurable for each input separately. In order for an alarm to function properly, the parameters shown in Table 12 are configured.

Table 12: Alarm function parameters

Alarm parameter	Description
Threshold:	The threshold specifies a value of an analog input when an alarm is to be triggered. When the analog input is above or below this threshold, the analog alarm enters its qualification period. After the qualification period has expired, the alarm is triggered.
Hysteresis:	The hysteresis is the value that an analog input must return to, in order for the alarm to be deactivated, or the qualification period to be reset. Normally in: <ul style="list-style-type: none"> • High alarm the hysteresis value is lower than the threshold, and • Low alarm the hysteresis value is higher than the threshold.
Qualification Period:	The qualification period is the length of time that the monitored analog input value must be within range, so that the alarm can be activated. During this period, if the analog input returns to within the normal range, the alarm is not triggered (see the example in the right hand side of Figure 11). The purpose of implementing a qualification period is to disallow a short pulse high input from triggering a false alarm. The qualification time could be set on milliseconds or a number of power cycles.

Figure 11: Analog alarm threshold, hysteresis and qualification period



Analog input point quality flag

An Analog Input includes the quality flags listed in Table 13.

Table 13: Analog input quality flags

Quality bit	Description
On-line	Indicates the online or offline state of an analog input point.
Restart	Indicates if the device (point) has restarted, but has not been initialized yet.
Communication Lost	This bit is set when this point is off-line.
Remote Forced Data	This bit is set when the point value is remote forced.
Local Forced Data	This bit is set when the point value is locally forced.
Over-range	This bit is set when the analog input exceeds the range.
Reference Check	This bit is set when the analog input reference is not set (may not be needed).

Analog input configuration settings

Table 14 lists the Analog Input configuration settings and recommended setting values:

Table 14: Analog input point configuration settings

Setting	Descriptions	Range	Default
General settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Bay Name	Specify the name of the bay to which the digital input belongs.		
Group Name	Specify a unique name used in conjunction with the below Point Description setting when referencing the Provider Application Digital Point information. The Group Name is used by the HMI for trending and event querying; therefore, using a label associated with the substation topology is recommended.	0 to 64 characters	
Point Name	Specify the name of the point. The Point Name should be unique within the bay and group to which it belongs.		

Setting	Descriptions	Range	Default
Point Description	Specify a descriptive label for the digital input. This setting is used in the HMI Application Point Status Viewer and Event Recorder.	0 to 128 characters	
Value Type	Specify the data type the Provider application uses when storing the digital input in the database. For detailed information on the Value Types and the specific Provider and Publisher settings, see Table 15: Provider IO and Publisher Protocol - Value Type : on page 68.	Discrete Signed or Unsigned Integer Signed Long Integer Short (32-bit IEEE format) Floating Double (64-bit IEEE format) Floating Message	
Initial Value	Specify the initial analog value that appears in the database during initialization. A value may be chosen which makes it convenient to identify the initialization value. For example, -50 for a 132 kV line would indicate this voltage has not been updated.		
Historical settings Note: The D20E does not currently support the Historical data settings.			
Calculation settings Note: In order to use the calculation tab for D20Es; under Provider IED Analog Input Protocol, the scale method must be set to calculation. Otherwise no calculation is applied on the Analog Input.			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Min Value	The function of the Min Value setting is determined by the selection made under Transform Method : <ul style="list-style-type: none"> Scale - Specify the minimum value permitted for this analog input. The DAP updates the database with this value whenever the device reports that this analog input value is less than this minimum. The minimum value must be set less than or equal to the associated Max Value setting. If no value is specified, the minimum value checking for this analog input is disabled, For detailed information on the IO Scale and the specific Provider settings, see Table 16: Provider- IO Scale: on page 68. Percentage - Specify the minimum range for this analog input. The DAP will use this value as its minimum range (0%) during its calculation. Percentage Example: <ul style="list-style-type: none"> Min Value = 0 Max Value = 1000 If percentage is at 50%, the Explore window shows 500 		

Setting	Descriptions	Range	Default
Max Value	<p>The function of the Max Value setting is determined by the selection made under Transform Method:</p> <ul style="list-style-type: none"> Scale - Specify the maximum value permitted for this analog input. The DAP updates the database with this value whenever the device reports that this analog input value is greater than this maximum. The maximum value must be set to a value greater than or equal to the associated Min Value setting. If no value is specified, the maximum value checking for this analog input is disabled. <p>For detailed information on the IO Scale and the specific Provider settings, see Table 16: Provider- IO Scale: on page 68.</p> <ul style="list-style-type: none"> Percentage - Specify the maximum range for this analog input. The DAP uses this value as its maximum range (100%) during its calculation. <p>Percentage Example:</p> <ul style="list-style-type: none"> Min Value = 0 Max Value = 1000 If percentage is at 50%, the Explore window shows 500 		
Offset/Min Raw Value	<p>Specify the Offset value or the Min Raw value:</p> <ul style="list-style-type: none"> The Offset value is only used when the Transform Method is set to Scale. The Offset is used to scale the raw value received from the device, the scaled value is stored in the DAPserver Studio database. Min Raw value is only used when the Transform Method is set to Percentage. The Min Raw value specifies the minimum raw value for the analog input. 		
Multiplier/Max Raw Value	<p>Specify the Multiplier value or the Max Raw value:</p> <ul style="list-style-type: none"> The Multiplier value is only used when the Transform Method is set to Scale. The Multiplier is used in conjunction with the Offset to scale the raw value received from the device. The Max Raw value is only used when the Transform Method is set to Percentage. The Max Raw value specifies the maximum raw value for the analog input. 	Multiplier: -10000000 to 10000000	Multiplier: 1 (disable)
Transform Method	<p>Specify the method used in transforming the raw value of the analog input to the engineering value. The available options are:</p> <ul style="list-style-type: none"> Scale; the equation for Provider Application Analog Input Scaling is: Data Base Value = (Raw Value * Multiplier) + Offset Percentage; the equation for Provider Application Analog Input Percentage is: $\text{Output} = \left(\frac{(\text{Input} - \text{Raw Min})}{(\text{Raw Max} - \text{Raw Min})} \times (\text{Max} - \text{Min}) \right) + \text{Min}$		
Event settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Qualification Time (ms)	Specify the time interval, in milliseconds, for which the AI must stay in a certain region before an event is generated.		
LL Limit	Specify the value for the lowest-value limit.		
LL Name	Specify the name for the lowest-value limit.		
L Limit	Specify the value for the low-value limit.		
L Name	Specify the name of the low-value limit.		

Setting	Descriptions	Range	Default
H Limit	Specify the value for the high-value limit.		
H Name	Specify the name of the high-value event.		
HH Limit	Specify the value for the highest-value limit.		
HH Name	Specify the name of the highest-value event.		
Rate of Change	Specify the threshold value against which the calculated change of ratio value is compared. Set the value to 0 in order to disable the alarm. Note: The Rate of Change will only be applied once the user has configured a Min and Max value for the specific Analog Input(s), within the Calculation tab.		0 (disable)
Rate of Change Name	Specify a name for the Rate of Change Event. If left empty, no Rate of Change Event is generated.		
Control settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Lower Control Point	Specify the digital output point associated with a lower operation applied to the analog input. A custom window allows for the association of an analog input to a digital output on the same device. This feature can be disabled by leaving this setting value empty; any lower control applied to this analog input subtracts one from the value of this analog input.		
Raise Control Point	Specify the digital output point associated with a raise operation applied to the analog input. A custom window allows for association of an analog input to a digital output on the same device. This feature can be disabled by leaving this setting value empty; any raise control applied to this analog input adds one to the value of this analog input.		
Providers - Protocol settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Value Name	Specify the name of the data attribute that holds the value (e.g., stVal, mag, etc.)		
Quality Name	Specify the name of the data attribute that holds the quality.		
Time Name	Specify the name of the attribute that holds the time stamp.		
Value Index	Read-only value for internal use.		
Quality Index	Read-only value for internal use.		
Time index	Read-only value for internal use.		
Publisher settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Point Description	Specify the point description of the mapped analog input.		

Setting	Descriptions	Range	Default
Value Type	Specify the data type the Publisher application uses when reporting the analog input.	Discrete Signed integer Unsigned integer Signed long integer Short floating (32-bit IEEE format) Double floating (64-bit IEEE format)	
RTDB Point	Specify the RTDB point whose value is reported for the analog input. A custom window allows you to associate the analog input to any analog input or counter available in the D20E.		

Table 15: Provider IO and Publisher Protocol - Value Type:

Value Type	Appropriate settings for D20E
Discrete	Not applicable for analog input value
Signed Integer	Negative or positive (bipolar) integer value
Unsigned Integer	No polarity (unipolar) integer value
Signed Long Integer	Negative or positive double standard size integer value
Short Floating	32-bit (sign, exponent, mantissa) IEEE 754 value; Default value, should be used always for Provider IO
Double Floating	64-bit (sign, exponent, mantissa) IEEE 754 value
Message	Not applicable for analog input value

Table 16: Provider- IO Scale:

IO Scale	Appropriate settings for D20E
Minus_5_to_5V	±5V full scale value (floating)
0_to_1mA	±1mA full scale value (floating)
0_to_5mA	±5mA full scale value (floating)
0_to_10mA	±10mA full scale value (floating); to be included in next release
0_to_20mA	±20mA full scale value (floating)
Raw	±16383 (14-bit) full scale value (floating or integer)
Percentage	±100% full scale value (floating); to be fixed

Set Analog Input for D20E IO Calculator function (example)

To set up the Analog Input for the calculation function (that is, for the raw standard (16 bit Integer) in the legacy D.20 Input/Outputs):

1. Navigate to **Settings > Providers > IO Provider > IED > Analog Input > Calculation**.
2. Set MULTIPLIER to a value of 2.
3. Navigate to **Settings > Providers > IO Provider > IED > Analog Input > Protocol**.
4. Set SCALE to **Calculation**.



You must set the scaling to Calculation in order for these settings to work. For details see the DAPserver Studio online help.

Analog input configuration procedure

When configuring a D20E for Analog Input from a Substation Controller device (for example: D20ME, D20MEII, or D20MX) or a Substation Gateway device (for example: D400 or DMC490), a signed 16 bit range (-32,768 to +32,767) is required from the D20E Publisher in a Signed Integer format.

Since the Raw value is a signed 15 bit value, it must be doubled.

For communication with a GE Grid Solutions:

- A D2x substation controller product supports Short Floating AI, which may benefit from the use of engineering units.
- The D400 substation gateway (and other newer products) support floating AI.

To configure the D20E Ethernet I/O Module for 16-bit signed integer AI format:

1. From the DAPserver Studio, go to **IO Provider > IED > Analog Input > Protocol**.
Result: The Protocol drop-down menu appears.
2. Select **Raw**.
3. Go to **DNP3 Publisher > View > Analog Input > General > Value**.
Result: The Value drop-down menu appears.
4. Select **Signed Integer**.
5. Go to **DNP3 Publisher > View > Analog Input > Protocol > Divisor** column.
6. Type **0.5** in the Divisor column.
7. Click **Save**.

For communication with a GE Grid Solutions device:

- A D2x substation controller product supports Short Floating AI, which may benefit from the use of engineering units.
- The D400 substation gateway (and other newer products) support floating AI.

Control output points

All control commands can only be executed when the control target point is online.

NOTICE

Only trip/close, raise/lower, and pulse operations are currently supported. Multiple point latching on digital outputs is not currently supported.

Control output type

A Control Output point can be configured into the counter types listed in Table 17.

Table 17: Control type descriptions

Control type	Description
Trip/Close Control	A type of control output that provides a trip open or close using one of two master relays and a select relay. During execution of the control command, the selected relay is set: <ul style="list-style-type: none"> • On after the master relay is set and • Off before the master relay is off.
Dual Point Counter	Refer to section: Dual point counter on page 60.
Form C Control	Uses 2 complementary contact outputs: <ul style="list-style-type: none"> • One normally open, and • One normally closed.
DPST Control	Double Pole, Single Throw with positive and negative control supply to drive an external interposer relay.
Raise/Lower Control	A type of control output that raises or lowers output voltage using a single select relay for each raise/lower control output.

Control output point quality flag

A digital control point includes the quality flags listed in Table 18.

Table 18: Digital control point quality flags

Quality flag	Description
On-line	This bit indicates an output's online/offline state.
Restart	This bit indicates if the device (point) has restarted, but has not been initialized yet.
Communication Lost	This bit is set when this point is off-line,
Remote Forced	This bit is set when the point is remote forced;
Local Forced	This bit is set when the point is locally forced.
Chatter Filer	This bit is set when the chatter file is active for this point (need confirm).
Reference Check	This bit is set when the analog input reference is not set (may not be needed).

Control output point configuration settings

The control/digital output is the control point in D20E-K and D20E-C modules.

Table 19 lists the Control/Digital Output Point configuration settings and recommended setting values.

Table 19: Control/Digital output points configuration settings

Setting	Descriptions	Range	Default
General settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Bay Name	Specify the name of the bay to which the digital output belongs.		
Group Name	Specify a unique name used in conjunction with the below Point Description setting when referencing the Provider Application Digital Point information. The Group Name is used by the HMI for trending and event querying; therefore, using a label associated with the substation topology is recommended.	0 to 64 characters	
Point Name	Specify the name of the point. The Point Name should be unique within the bay and group to which it belongs.		
Point Description	Specify a descriptive label for the digital output point. This setting is used in the HMI Application Point Status Viewer and Event Recorder.	0 to 128 characters	
Value Type	Specify the data type the Provider application uses when storing the digital output in the database.	Single Point Double Point	
Initial Value	Specify the initial counter value that appears in the database during initialization.	Open Close	
Command Type	Specify the digital output type used to command the remote device.	Trip/Close Regulating step Reset Freeze	Trip/ Close

Setting	Descriptions	Range	Default
Off Name	Specify the name of the digital output point when it is in an off state: <ul style="list-style-type: none"> • Single Point Digital Input - Off state = 0 • Double Point Digital Input - Off state = 1 The name can be entered manually, or double-click and select from the drop-down menu.	ASCII	
On Name	Specify the name of the digital output point when it is in an on state: <ul style="list-style-type: none"> • Single Point Digital Input - On state = 1 • Double Point Digital Input - On state = 2 The name can be entered manually, or double-click and select from the drop-down menu.	ASCII	
Control settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Associate Output DI or Event	Specify the feedback digital input (typically a pseudo digital input or counter) for the digital output. The associated digital input point will change state based on the digital output state.		
Trip Interlocking	Specify the interlock condition for trip operation on the digital output using script.		
Close Interlocking	Specify the interlock condition for close operation on the digital output using script.		
Operate Method	Specify the Digital Output method that applies to this DO. The following operation methods are available: <ul style="list-style-type: none"> • Direct • Select Before Operate (SBO) If this value is set to Direct , both the Direct and Select Before Operate commands are accepted by this point. If this value is set to SBO , only the Select Before Operate command is accepted.		
Operate Timeouts	Specify the maximum amount of time, in milliseconds, allowed between the Select command and Operate command. The setting is applied when the Operate Method is set to SBO .	1000 to 60000 milliseconds	10000 (10 seconds)
Providers - Protocol settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Physical Index	Specify the index number of a Digital Output point. It is recommended to use one-based increment counting.		1, 2, ..., 8
Type	Specify the relay control type. The relay type setting is to coincide with hardware jumper setting in either Table 22: D20E-K - summary of control types and jumper setting positions on page 89, or Table 27: D20E-C - summary of control types and jumper setting positions on page 99.	Trip/Close Form C DPSTI Raise/Lower	Trip/Close
Activity Timer	Specify the length of time (in milliseconds) before the signal is set to inactive.	0 to 100000 ms	10 ms

Setting	Descriptions	Range	Default
Number of Pulses	Specify the number of pulses to be sent. A value of 0 (zero) specifies continuous pulses. Pulses are only supported on the Raise/Lower boards. Note: A pulse count on Trip/Close or Form C boards prevents the controls from operating.	1 to 20000 pulses	1 pulse
Pulse On Duration	Specify the length of Pulse ON, in ms. DNP3.0 controls overwrites this setting with the ON time from the remote client. Controls with an ON duration <20ms do not operate. Controls received with an ON duration of 0ms execute with the specified Pulse ON Duration.	20 to 100000 ms	50 ms
Pulse Off Duration	Specify the length of Pulse OFF, in ms. DNP3 controls overwrites this setting with the OFF time from the remote client. Controls received with an OFF duration <20ms will execute with a default of 50ms.	20 to 100000 ms	50 ms
Publisher settings			
Reference Name	Specify a text string that combines the bay name, group name, and provider name from the General tab.		
Point Description	Specify the point description of the mapped digital output.		
Value Type	Specify the date type the Publisher application uses when reporting the Digital Output when supported by the protocol.	Single point Double point	
Open Output DO	Specify the RTDB point associated with the digital output for a close operation. A custom window allows you to associate the digital output to any digital output, digital input or analog input available in the D20E.		
Close Output DO	Specify the RTDB point associated with the digital output for an open operation. A custom window allows you to associate the digital output to any digital output, digital input or analog input available in the D20E.		
Operation Method	Specify the control operation. The digital output options vary per protocol. Ensure that the selected operation format matches the control to be issued from the remote Client.	Trip/close an output in the remote device Regulating step operation in the remote device Reset the remote device Freeze the counters in the remote device Trip Only an output in the remote device Close Only an output in the remote device	

Check operation of the D20E

The DAPserver Studio Explore screen can be used to check and access the following operations on a D20E module:

- [Operation of control output points](#) on page 73
- [Access the Event Log](#) on page 73
- [Check the D20E system status](#) on page 73

Operation of control output points

To operate control points:

1. Go to the **Device** menu > **Explore** tab view.
2. Click on the device name associated with the green thumbs-up icon shown in PROVIDERS field located on the middle far-left of the screen.
3. Click on the green thumbs-up Device icon in the upper-left of the main window.
4. Click on **Digital Output** located on the left of the main window pane under Health. All of the configured control output points will appear.
5. Click on one of the desired control output points to be operated.

For example:

- 5.1. Click Digital Output #1 > **Remote Control** at the top-right.
Result: A pop-up window appears.
 - 5.2. Drag the **Control** slider switch to the right.
Result: The Remote Control switch is disabled.
6. Click **OK**.
Result: The pop-up window closes.

Check the D20E system status

To view the system status:

- Go to the **Device** menu > **Explore** tab view.
Result: The system status appears in the top section of the Explore window; see [Figure 7: Explore window - Main window and Event window](#) on page 41

Access the Event Log

To view the Event Log:

- Go to the **Device** menu > **Explore** tab view.
Result: The Event Log appears in the bottom section of the Explore window; see [Figure 7: Explore window - Main window and Event window](#) on page 41

Make D20E device setting changes

Device setting changes are made through the Settings menu bar. Refer to the DAPserver Studio online help for details on the Settings menu bar items:

- General; see DAPserver Studio Settings Menu book > **General** topic
 - General
 - Active System Pseudo
 - Configuration Management
- Providers; see DAPserver Studio Settings Menu book > **Providers** topic
 - General
 - Access Point
 - Protocol
 - Pseudo
 - IED

For detailed information on the **Value Types** and the specific Provider and Publisher settings, see [Table 15: Provider IO and Publisher Protocol - Value Type](#): on page 68.

For detailed information on the IO Scale and the specific Provider settings, see [Table 16: Provider- IO Scale](#): on page 68.

- Publishers; see DAPserver Studio Settings Menu book > **Publishers** topic
 - General
 - Access Point
 - Pseudo
 - View

For detailed information on the **Value Types** and the specific Provider and Publisher settings, see [Table 15: Provider IO and Publisher Protocol - Value Type](#): on page 68.

D20E Ethernet I/O Module

Chapter 4: Mounting a D20E Module

This chapter describes:

- [Mounting](#) on page 75
- [Rack spacing](#) on page 75
- [Rack mounting procedure](#) on page 76

Mounting

Once you have configured your D20E module, you can:

1. Physically locate and mount it in a 19" rack or cabinet.
2. Connect ground, power and link cabling
3. Turn power on to the module, and test it to make sure D20E module is functioning properly.

It is recommended that you complete the above tasks, before you connect and test your field wiring.

Rack spacing

When mounting multiple D20E modules in a rack, or when mounting D20E modules in a rack with other equipment, verify that there is at least one rack unit (RU) of space above and below the D20E module to allow for cooling air flow and cable routing (1 RU = 1.75 inches or 44.5 mm).

Required clearances

The exterior dimensions of the D20E module are:

- 19" wide x 5.2" high x 1.6" deep (483 mm x 132 mm x 63.5 mm)

Rack mounting procedure

To mount the D20E module in a rack:

1. Determine the location of the D20E module in a 19-inch mounting rack.
2. Install, but do not tighten the top two mounting screws.



NOTE

Install the D20E module with the LEDs visible from the front of the rack.

3. Slide the D20E module over the top mounting screws and drop down into position.
4. Insert the bottom mounting screws.
5. Tighten all four mounting screws.

You are now ready to connect ground, power, and network link cabling to the D20E module:

See chapter: [Mounting a D20E Module](#) on page 75.

See chapter: [Connecting Field Wiring to the D20E Module](#) on page 87

D20E Ethernet I/O Module

Chapter 5: Connecting to Devices and Networks

This chapter provides guidelines for making physical connections between the D20E and substation and network devices:

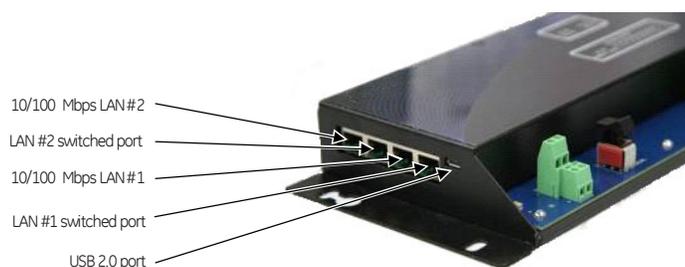
- [D20E connectors](#) on page 77
- [Console port](#) on page 78
- [Network data communication](#) on page 79
- [Daisy-chaining D20E modules](#) on page 82

D20E connectors

The side panel of the D20E model provides the following connectors (see Figure 12):

- Four RJ45 connectors
The two RJ45 connectors shown on the left side are for the LAN 2 or Ethernet™ 2 switch.
The two RJ45 connectors shown on the right side are for the LAN 1 or Ethernet™ 1 switch.
- One USB connector
The USB connector shown on the far-right allows you to connect a computer to a D20E for device setup and servicing.

Figure 12: D20E side panel Ethernet and USB connectors



Console port

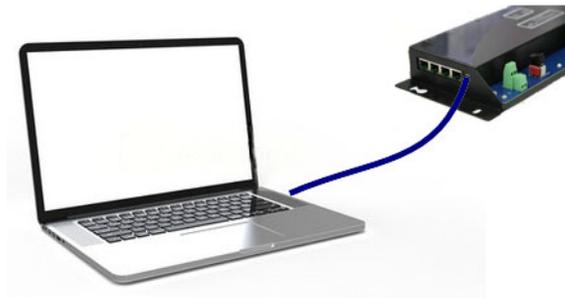
Console port connection

The USB 2.0 (micro AB jack) console port allows you to set up and debug the D20E modules. Figure 13 shows the connection from a PC to a D20E module.

The console port provides an SSH- encrypted IP interface providing you with a standard Linux command line interface for running system debug and low-level commands.

The default IP address is "10.0.0.1". You can access the console port with a LAN-based ASCII VT terminal emulator, such as Putty Emulator.

Figure 13: D20E USB Console Port



Set up the console port

The USB console port provides easy access to Linux OS command line instructions with an IP-based USB connection.

To set up the USB console connection:

1. Power up the D20E and connect a cable with a USB micro AB plug between the PC and the D20E as shown in Figure 13.

Results: If Windows does not automatically install the USB driver, refer to the MS web site for the appropriate USB driver (remote NDIS Compatible device) installation procedure, which is dependent upon the Windows OS version.

2. After the USB driver is successfully installed, run Windows **command**.

Result: The Command Prompt window appears.

3. Execute the **C:\ipconfig** command and make sure a new Ethernet adapter is installed with a new IP address of 10.0.0.x.

If the new Ethernet adapter is not installed with a new IP address, open the network property tab to manually add in the IP address 10.0.0.x (where, x is 2 to 254).

Execute the **C:\ipconfig** command again to verify the IP address.

4. Run a terminal emulator, connecting to IP address 10.0.0.1:22 with SSH encryption to establish the connection to the D20E module.

5. Logon to the D20E with the default user ID **root**, and a default password **root**.

Result: The Linux command prompt appears.

a new IP address of 10.0.0.x

Network data communication

The D20E modules network communication uses two redundant switched 10/100Base-T interfaces, with RJ45 connections for category 5 UTP cable. This is implemented with either of the following protocols:

- DNP3 TCP/IP or
- IEC 61850 GGIO.

There are two switched LAN Ports on the D20E modules:

- LAN 1 and
- LAN 2.

Each LAN port has a dual switched physical connection, where two RJ45 connectors for LAN 1 share the same MAC and IP address and two RJ45 connectors for LAN 2 sharing another one.

The Ethernet ports can also be used to configure a D20E module when connected to a Windows PC computer running the DAPserver Studio.

Network address setting and or modification

The D20E modules have two predefined default IP addresses:

- LAN 1 = 192.168.0.189 on eth0 and
- LAN 2 = 192.168.1.189 on eth1.

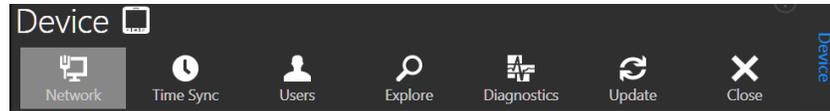
You can change the default IP addresses to new IP addresses to match your network IP address assignments.

Typically, you can modify an IP address from DAPserver Studio

In the unlikely event that you are unable to access the D20E Ethernet I/O Module from DAPserver Studio, it may be necessary to modify an IP address using Linux.

To modify an IP address using DAPserver Studio:

1. Run DAPserver Studio.
2. Open a D20E module configuration.
3. Connect to the D20E module, using the D20E module IP address (for example, 192.168.0.189) with administrator access rights.
4. Click on the Device menu > Network icon to open the device level configuration pager.



5. Type in the D20E module IP Address (for example, 192.168.0.189).
6. Enter the proper login credentials.

7. Press **OK**.
Result: DAPserver Studio suite is connected to the D20E module.
Result: The Network Configuration window appears as shown in [Figure 8: Network window](#) on page 42.



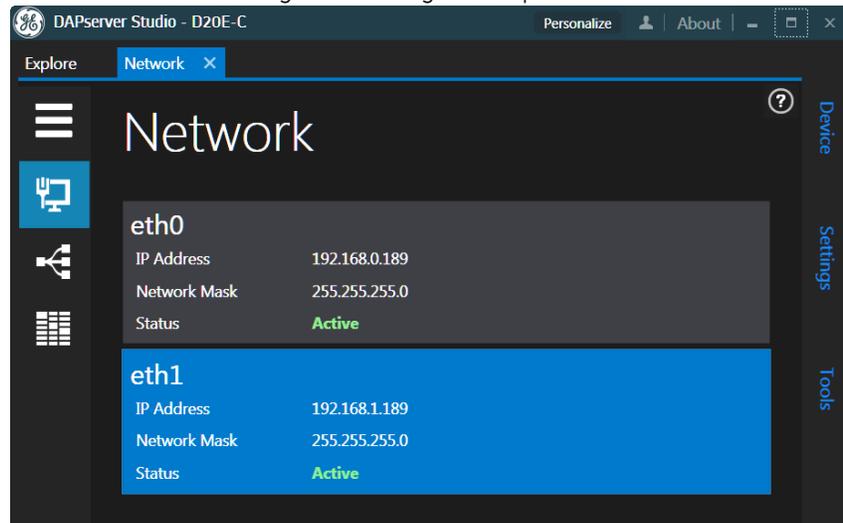
NOTE

If the D20E module already has an assigned IP address on each LAN port, you can connect the device with the existing LAN port.

8. Click **eth0**.
 - 8.1. Change the:
 - IP address,
 - Network mask and
 - Default gateway.
 - 8.2. Ensure that the **Active** check-box is selected.
 - 8.3. Press **OK**.
Result: The changes are saved.
9. Repeat step 8. for **eth1**.
10. Right-click a blank area of the screen.
Result: The Task bar appears at the bottom of the screen.
11. Click **Sync**.
Result: DAPserver Studio updates the D20E module with the new IP address and restarts the device.

12. Reboot the device, if necessary; see [Rebooting the D20E](#) on page 116

Result: The IP address assignment change is complete.



NOTE

To modify an IP address using a Linux OS Shell:

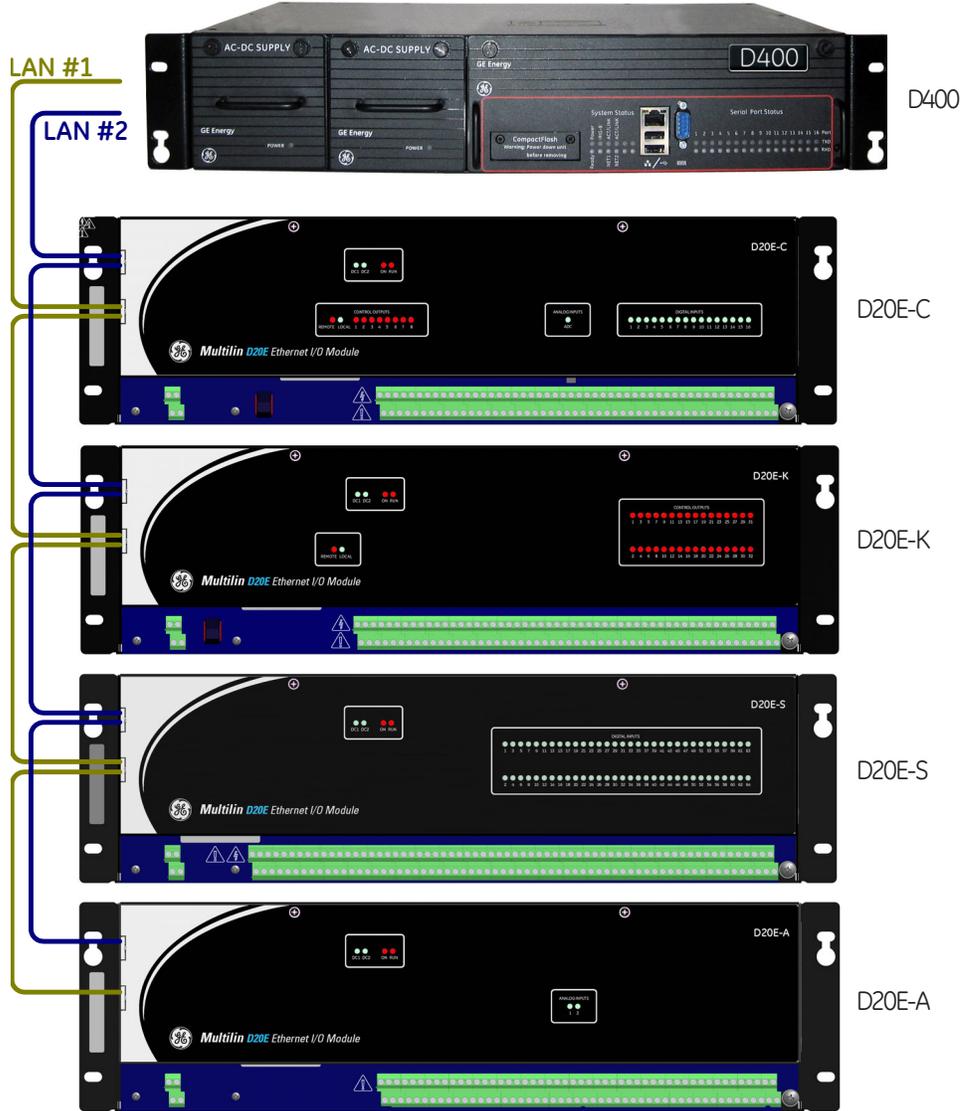
Normally, rebooting the D20E module is not required. However for some network security control, rebooting is necessary when a new IP address is assigned onto a network.

1. Connect a cable with a USB micro AB plug between the PC and D20E Ethernet I/O Module as shown in Figure 13.
2. Run the terminal emulation application.
See section [Terminal emulator](#) on page 21 for details.
3. Logon to the D20E module with:
 - IP address: **10.0.0.1**.
 - User ID **root**, and
 - Password **root**.
4. Execute the **ifconfig** Linux command to check the current IP addresses for LAN 1 (eth0) and LAN 2 (eth1).
The file name is ifcfg-eth0.
5. Change the directory with command **CD /etc/sysconfig/network-scripts/**.
6. Run the standard Linux vi command to open the file: **vi ifcfg-eth0**.
7. Edit eth0 with a new IP address; for example, 192.168.0.189 (or obtain an IP address from your network administrator):
 - 7.1. Open edit mode; press "i" (insert) and navigate with the arrow keys.
 - 7.2. Change the IP Address.
 - 7.3. Press **Esc** to exit insert mode.
 - 7.4. Type ":" [Shift + ;].
 - 7.5. Enter one of the following commands.
 - **wq** command to write and quit (save changes)
 - **q!** command to discard changes and quit
 - 7.6. Exit the file by pressing **Enter**.
8. Repeat step 6. and step 7. for eth1 using the **ifcfg-eth1** command.
9. Save the change.
10. Run the **ifconfig** command again to check that the IP addresses have changed as expected.

Daisy-chaining D20E modules

The daisy chaining of D20E Ethernet I/O Modules is shown in Figure 13.

Figure 14: Daisy chaining of D20E modules



D20E Ethernet I/O Module

Chapter 6: Preliminary Power Up and Test

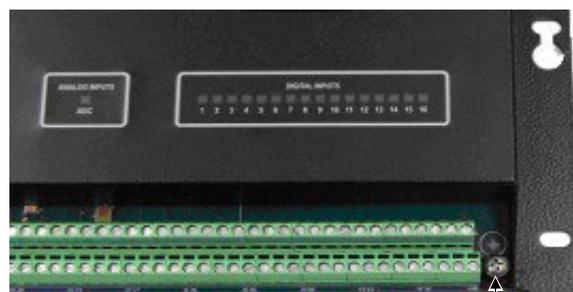
This chapter describes:

- [Safety and protective earth grounding](#) on page 83
- [Power source connection](#) on page 84
- [Power supply requirements](#) on page 85
- [Preliminary power-up and test procedure](#) on page 85

Safety and protective earth grounding

Surge and noise suppression components used on the D20E module conduct during transients to prevent mal-operation or damage to internal devices. To ensure shunting of transients from points to ground and to ensure that the D20E module has a bonded safety earth ground, the D20E module's earth ground point must be connected to a low impedance ground using a braided cable or a solid copper conductor (minimum 4 mm² (#12 AWG) wire is recommended). The connection must be made to the #10 safety/protective earth screw and lock washer stud located on the lower-right-side of a D20E module (see Figure 15) with a ring lug. When making ground connections, ensure that all surfaces that are used for grounding are free of dirt, residue and corrosion.

Figure 15: D20E protective earth ground

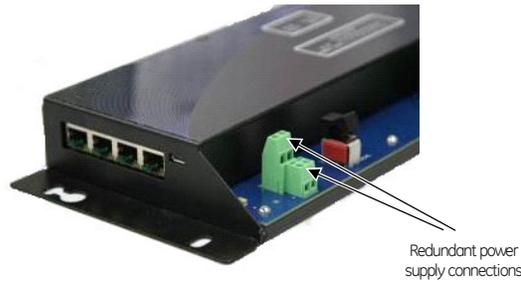


Safety and protective earth ground screw

Power source connection

Each D20E module requires 5W of power using an external 24/48 VDC power supply. Figure 16 shows the location of the redundant power supply connections.

Figure 16: D20E redundant power supply connections



CAUTION

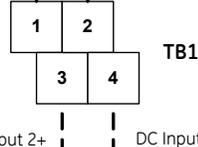
The wiring connected to terminal block TB1 must not have exposed accessible conductors.

The wire and cable connected must have at least a +80 °C temperature rating.

CAUTION

Ensure that the external power source is shut off before connecting or disconnecting the power supply to the D20E Ethernet I/O Module. Use an approved external 20A switch or circuit breaker that opens all conductors simultaneously. The switch or circuit breaker must be suitably located, easily reached, and labeled appropriately.

Table 20: D20E-DC power and i/o supply connections

Power supply type	Description
D20E External Power Supply connection	DC Input 1+ DC Input 1-  DC Input 2+ DC Input 2-
D20E-K Control Output External Supply	TB2-54 (+/-)
D20E-K (DB25) Interface	TB2-1 (-/+)
	TB2-3 (+/-)
	TB2-1 (-/+)
D20E-S Digital Input Wetting External Supply	TB2-65 (+/-)
	TB2-131 (-/+)
D20E-A Analog Input Loop External Supply	TB2-49 (+)
	TB2-99 (-)
D20E-C Digital Input Wetting External Supply and Control Output External Supply	TB2-1 (+/-) Digital Input (Control Output supply for DPST) TB2-51 (-/+) Digital Input (Control Output supply common return) TB2-2 (+/-) Control Output (Trip/Close and Raise/Lower)



The Control Output external supplies listed above must be connected in order to facilitate the D20E-K (see section [Control output external supply](#) on page 90) and D20E-C Remote/Local switch (see section [D20E-C module -Local/Remote switch](#) on page 100).

Power supply requirements

If you did not order a GE Grid Solutions power supply (see [Ordering guides](#) on page 23 > D20E Power Supply), and instead are obtaining a non-GE power supply, ensure that you purchase a power supply unit that is:

- Certified for use in the country of the installation
- Includes double insulation or reinforced insulation
- Supports overvoltage category II

Ensure that the power supply cable used is:

- No longer than 10 m (32.8 ft)
- Not run in parallel with a noise source

Preliminary power-up and test procedure

To verify the previous installation tasks have been successfully completed:

1. Power up the D20E device.
2. Login to a DAPserver Studio session.
3. Verify the firmware version:
 - 3.1. Open DAPserver Studio.
 - 3.2. From the Device menu, click **Explore > System > Health > Item 24 > FMWVER**.
4. Confirm that:
 - The correct firmware and configuration are loaded on the D20E device.
 - All communication, network and power connections have been properly connected.

D20E Ethernet I/O Module

Chapter 7: Connecting Field Wiring to the D20E Module

This chapter describes the I/O connection for each type of D20E module:

- [D20E-A analog inputs module](#) on page 87
- [D20E-K control outputs module](#) on page 89
- [D20E-S digital inputs module](#) on page 95
- [D20E-C combination inputs and outputs module](#) on page 97

Field wiring is connected to the D20E modules at terminal block TB2.

D20E-A analog inputs module

The D20E-A supports up to 32 differential analog inputs. The field terminations for analog inputs are provided by TB2-1 to TB2-48 and TB2-51 to TB2-98 (See Table 21 for details).

One shield termination is allocated for each input.

Table 21 lists the TB2 terminal block connection assignments for the D20E-A.



The wiring connected to terminal block TB2 must not have exposed accessible conductors.

The wire and cable connected must have at least a +80 °C temperature rating.

Table 21: D20E-A - analog input module terminal block assignments

TB2	Descriptions	TB2	Descriptions
1	Analog Input 1+	51	Analog Input 1–
2	Shield/Screen Ground	52	Shield/Screen Ground
3	Analog Input 2+	53	Analog Input 2–
4	Analog Input 3+	54	Analog Input 3–
5	Shield/Screen Ground	55	Shield/Screen Ground
6	Analog Input 4+	56	Analog Input 4–
7	Analog Input 5+	57	Analog Input 5–
8	Shield/Screen Ground	58	Shield/Screen Ground
9	Analog Input 6+	59	Analog Input 6–
10	Analog Input 7+	60	Analog Input 7–

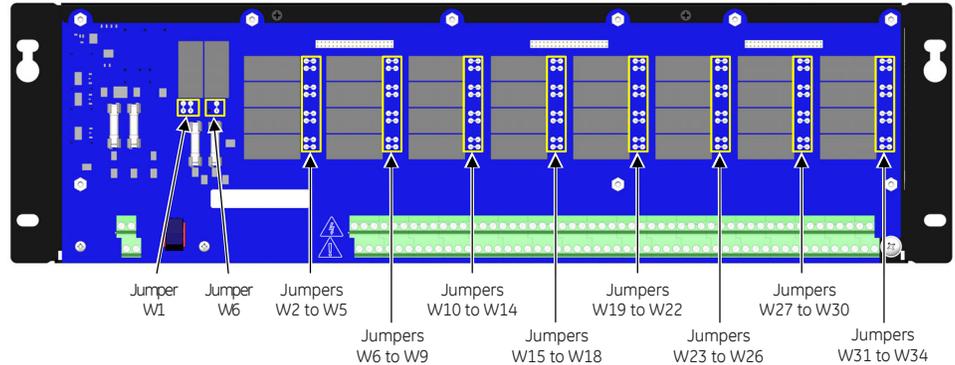
TB2	Descriptions	TB2	Descriptions
11	Shield/Screen Ground	61	Shield/Screen Ground
12	Analog Input 8+	62	Analog Input 8-
13	Analog Input 9+	63	Analog Input 9-
14	Shield/Screen Ground	64	Shield/Screen Ground
15	Analog Input 10+	65	Analog Input 10-
16	Analog Input 11+	66	Analog Input 11-
17	Shield/Screen Ground	67	Shield/Screen Ground
18	Analog Input 12+	68	Analog Input 12-
19	Analog Input 13+	69	Analog Input 13-
20	Shield/Screen Ground	70	Shield/Screen Ground
21	Analog Input 14+	71	Analog Input 14-
22	Analog Input 15+	72	Analog Input 15-
23	Shield/Screen Ground	73	Shield/Screen Ground
24	Analog Input 16+	74	Analog Input 16-
25	Analog Input 17+	75	Analog Input 17-
26	Shield/Screen Ground	76	Shield/Screen Ground
27	Analog Input 18+	77	Analog Input 18-
28	Analog Input 19+	78	Analog Input 19-
29	Shield/Screen Ground	79	Shield/Screen Ground
30	Analog Input 20+	80	Analog Input 20-
31	Analog Input 21+	81	Analog Input 21-
32	Shield/Screen Ground	82	Shield/Screen Ground
33	Analog Input 22+	83	Analog Input 22-
34	Analog Input 23+	84	Analog Input 23-
35	Shield/Screen Ground	85	Shield/Screen Ground
36	Analog Input 24+	86	Analog Input 24-
37	Analog Input 25+	87	Analog Input 25-
38	Shield/Screen Ground	88	Shield/Screen Ground
39	Analog Input 26+	89	Analog Input 26-
40	Analog Input 27+	90	Analog Input 27-
41	Shield/Screen Ground	91	Shield/Screen Ground
42	Analog Input 28+	92	Analog Input 28-
43	Analog Input 29+	93	Analog Input 29-
44	Shield/Screen Ground	94	Shield/Screen Ground
45	Analog Input 30+	95	Analog Input 30-
46	Analog Input 31+	96	Analog Input 31-
47	Shield/Screen Ground	97	Shield/Screen Ground
48	Analog Input 32+	98	Analog Input 32-
49	External AI DC Loop Supply (+)	99	External AI DC Loop Supply (-)
50	Chassis Earth Ground (PE GND on #10 stud)	100	Chassis Earth Ground (PE GND on #10 stud)

D20E-K control outputs module

The D20E-K has 34 on-board relays that are factory configured into a variety of output types; see Table 22 for connection details.

The W1, W2 to W5, and W7-W34 jumpers are located on the D20E-K as shown in Figure 17.

Figure 17: D20E-K module - jumper locations



See Table 23 for terminal block connection details.

Table 22: D20E-K - summary of control types and jumper setting positions

Control Type	Jumper and Supply	Setting
Trip/Close Trip/Close supply: TB2-54(+/-) and TB2-1(-/+) Jumper W1: 1 & 4, 2 & 3	W2-W5, W7-W34	
	W6	
DPST DPST supply: TB2-54(+/-) and TB2-1(-/+) Jumper W1: 1 and 2	W2-W5, W7-W34	
	W6	
Form C REMOTE/LOCAL switch supply: TB2-54(+) and TB2-1(-)	W2-W5, W7-W34	
	W6	
Raise/Lower Raise/Lower supply: TB2-54(+/-) and TB2-1(-/+) Jumper W1: 1 & 2	W2-W5, W7-W34	
	W6	



See Table 24 (and Notes) for D20E-K (DB25) Interface jumper settings and terminal block connections.

Control output external supply

The external control output supply connections must be made on TB2-54(+/-) and TB2-1(-/+) in order to facilitate the Remote/Local switch. For the D20E-K (DB25) Interface: TB2-3(+/-) and TB2-1(-/+).

Remote/Local switch

The remote/local switch (S1) disables the operation of control outputs when in the local position. Both the external control output supply and the control relays are disabled by switch S1 when in the LOCAL position. Figure 18 shows the location of the REMOTE/LOCAL switch.

Figure 18: D20E-K REMOTE/LOCAL Switch



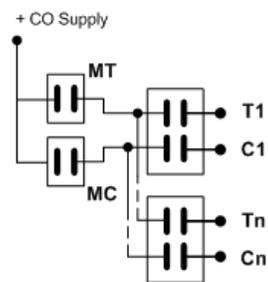
The D20E Remote/Local switch is disabled by default. To enable the remote/local switch, follow the procedure described in section: [Operation of control output points](#) on page 73, and enable **Control**. For example, the remote/local switch must be enabled for operation with the D20MX Substation Controller.

Trip/Close Control Outputs

Trip/Close control outputs require the closing of two relays before voltage appears at the control output. The two relays must be either a Master Trip relay or a Master Close relay, and the associated select relay for the control output to be operated.

Figure shows the Trip/Close control output path. For the Trip/Close configuration the control supply is connected between on TB2-54 for positive polarity and TB2-1 for negative polarity. There are 32 dual Trip/Close outputs supported on the D20E-K.

Figure 19: Trip/Close outputs



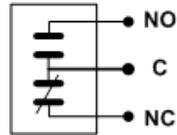
Form C control outputs

The Form C control output is a dry contact output. The control uses two complementary outputs (see Figure 20):

- One normally open, and
- One normally closed.

There are 32 Form C control outputs that can be configured on the D20E-K.

Figure 20: Form C outputs



Raise/Lower control outputs

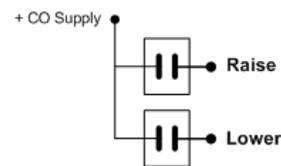
A Raise/Lower control output uses either a raise relay or a lower relay to increment or decrement a value (i.e., tap changer).

Each Raise/Lower set uses two control output select relays (see Figure 21):

- One for the raise and
- One for the lower.

This supports 16 Raise/Lower control outputs using 32 select relays on the D20E-K.

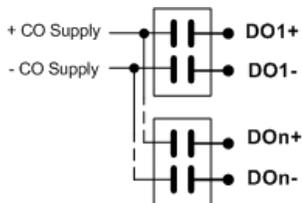
Figure 21: Raise/Lower outputs



DPST control outputs

Each Double Pole Single Throw (DPST) output only requires one relay to be energized to perform a control output operation. Both supply polarity leads are switched (see Figure 22).

Figure 22: DPST outputs



DPST outputs are shown as DO(+/-) in Table 23. 32 single DPST outputs are available on the D20E-K.

CAUTION

The wiring connected to terminal block TB2 must not have exposed accessible conductors.

The wire and cable connected must have at least a +80 °C temperature rating.

Table 23: D20E-K - control output module terminal block assignments

TB2	Description	TB2	Description
1	External Control Output DC Supply (-/+)	54	External Control Output DC Supply (+/-)
2	No Connection	55	No Connection
3	No Connection	56	Interposer Current Limit Input
4	Trip1/Raise16/Normal Open1/DO1+	57	Close1/Common1/DO1-
5	Normal Close1	58	Trip2/Lower16/Normal Open2/DO2+
6	Close2/Common2/DO2-	59	Normal Close2
7	Trip3/Raise15/Normal Open3/DO3+	60	Close3/Common3/DO3-
8	Normal Close3	61	Trip4/Lower15/Normal Open4/DO4+
9	Close4/Common4/DO4-	62	Normal Close4
10	Trip5/Raise14/Normal Open5/DO5+	63	Close5/Common5/DO5-
11	Normal Close5	64	Trip6/Lower14/Normal Open6/DO6+
12	Close6/Common6/DO6-	65	Normal Close6
13	Trip7/Raise13/Normal Open7/DO7+	66	Close7/Common7/DO7-
14	Normal Close7	67	Trip8/Lower13/Normal Open8/DO8+
15	Close8/Common8/DO8-	68	Normal Close8
16	Trip9/Raise12/Normal Open9/DO9+	69	Close9/Common9/DO9-
17	Normal Close9	70	Trip10/Lower12/Normal Open10/DO10+
18	Close10/Common10/DO10-	71	Normal Close10
19	Trip11/Raise11/Normal Open11/DO11+	72	Close11/Common11/DO11-
20	Normal Close11	73	Trip12/Lower11/Normal Open12/DO12+
21	Close12/Common12/DO12-	74	Normal Close12
22	Trip13/Raise10/Normal Open13/DO13+	75	Close13/Common13/DO13-
23	Normal Close13	76	Trip14/Lower10/Normal Open14/DO14+
24	Close14/Common14/DO14-	77	Normal Close14
25	Trip15/Raise9/Normal Open15/DO15+	78	Close15/Common15/DO15-
26	Normal Close15	79	Trip16/Lower9/Normal Open16/DO16+
27	Close16/Common16/DO16-	80	Normal Close16
28	Trip17/Raise8/Normal Open17/DO17+	81	Close17/Common17/DO17-
29	Normal Close17	82	Trip18/Lower8/Normal Open18/DO18+
30	Close18/Common18/DO18-	83	Normal Close18
31	Trip19/Raise7/Normal Open19/DO19+	84	Close19/Common19/DO19-
32	Normal Close19	85	Trip20/Lower7/Normal Open20/DO20+
33	Close20/Common20/DO20-	86	Normal Close20
34	Trip21/Raise6/Normal Open21/DO21+	87	Close21/Common21/DO21-
35	Normal Close21	88	Trip22/Lower6/Normal Open22/DO22+
36	Close22/Common22/DO22-	89	Normal Close22
37	Trip23/Raise5/Normal Open23/DO23+	90	Close23/Common23/DO23-
38	Normal Close23	91	Trip24/Lower5/Normal Open24/DO24+
39	Close24/Common24/DO24-	92	Normal Close24
40	Trip25/Raise4/Normal Open25/DO25+	93	Close25/Common25/DO25-
41	Normal Close25	94	Trip26/Lower4/Normal Open26/DO26+
42	Close26/Common26/DO26-	95	Normal Close26
43	Trip27/Raise3/Normal Open27/DO27+	96	Close27/Common27/DO27-
44	Normal Close27	97	Trip28/Lower3/Normal Open28/DO28+
45	Close28/Common28/DO28-	98	Normal Close28
46	Trip29/Raise2/Normal Open29/DO29+	99	Close29/Common29/DO29-

TB2	Description	TB2	Description
47	Normal Close29	100	Trip30/Lower2/Normal Open30/DO30+
48	Close30/Common30/DO30-	101	Normal Close30
49	Trip31/Raise1/Normal Open31/DO31+	102	Close31/Common31/DO31-
50	Normal Close31	103	Trip32/Lower1/Normal Open32/DO32+
51	Close32/Common32/DO32-	104	Normal Close32
52	Master Close Sense Output	105	Master Trip Sense Output
53	No Connection	106	No Connection (PE GND on #10 stud)

Table 24 shows the J1-J6 DB25 connector pin assignments for the D20E-K (DB25) interface.

Table 24: D20E-K (DB25) interface - DB25 pin assignment

	Pins	Trip/Close Outputs				Raise/Lower Outputs		
		J1 (1 to 8)	J5 (9 to 16)	J6 (17 to 24)	J4 (25 to 32)	J3 (1 to 8)	J2 (9 to 16)	
WESTERN D20 KI (T/C 1 to 8 or R/L 1 to 4)	1	T1	T9	T17	T25	R8	R16	
	2	C1	C9	C17	C25	L8	L16	
	3	T2	T10	T18	T26	R7	R15	
	4	C2	C10	C18	C26	L7	L15	
	5	T3	T11	T19	T27	R6	R14	
	6	C3	C11	C19	C27	L6	L14	
	7	T4	T12	T20	T28	R5	R13	
	8	C4	C12	C20	C28	L5	L13	
	9	T5	T13	T21	T29	R4	R12	
	10	C5	C13	C21	C29	L4	L12	
	11	T6	T14	T22	T30	R3	R11	
	12	C6	C14	C22	C30	L3	L11	
	13	T7	T15	T23	T31	R2	R10	
	14	C7	C15	C23	C31	L2	L10	
	15	T8	T16	T24	T32	R1	R9	
	16	C8(Z2:1&2) T1(Z2:2&3)	C16(Z3:1&2) T6(Z3:2&3)	C24(Z7:1&2) T21(Z7:2&3)	C32(Z6:1&2) T26(Z6:2&3)	L1(Z5:1&2) T16(Z5:2&3)	L9(Z4:1&2) T11(Z4:2&3)	Relay Panels (T/C 1-30)
17	C1	C6	C21	C26	C16	C11		
18	T2	T7	T22	T27	T17	T12		
19	C2	C7	C22	C27	C17	C12		
20	T3	T8	T23	T28	T18	T13		
21	C3	C8	C23	C28	C18	C13		
22	T4	T9	T24	T29	T19	T14		
23	C4	C9	C24	C29	C19	C14		
24	T5	T10	T25	T30	T20	T15		
25	C5	C10	C25	C30	C20	C15		



Z1: 1&4, 2&3 Trip/Close outputs

Z1: 1&2 Raise/Lower outputs

See Z2-Z7 jumper settings in Table 24 above. See the locations of jumpers Z1 to Z7 in Figure 23.

TB2-1: External Control Output DC Supply (-/+)

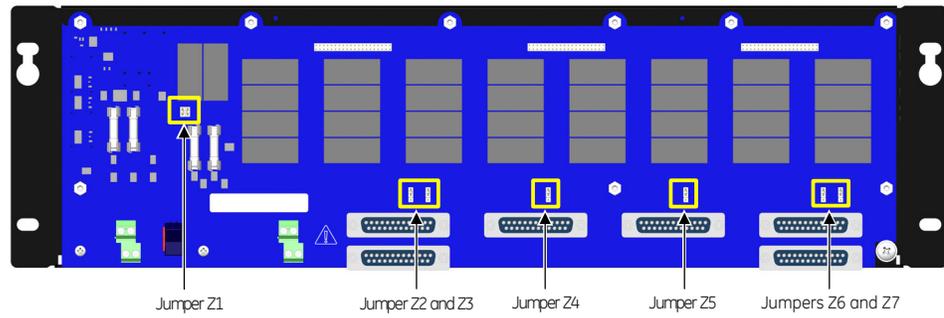
TB2-2: No Connection

TB2-3: External Control Output DC Supply (+/-)

TB2-4: Interposer Current Limit Input

The Z1, Z2 - Z7 jumpers are located on the D20E-K (DB25) interface module as shown in Figure 23.

Figure 23: D20E-K (DB25) interface module - jumper locations



D20E-S digital inputs module

The D20E-S module provides 64 digital input connections (see the terminal block assignments in Table 25) with the:

- Field terminations assigned between TB2-1 to TB2-64 and
- Dry contact wetting common on TB2-67 to TB2-130.
- External digital input supply connections on TB2-65 (+/-) and TB2-131 (-/+)



The wiring connected to terminal block TB2 must not have exposed accessible conductors.

The wire and cable connected must have at least a +80 °C temperature rating.

Table 25: D20E-S - digital input module terminal block assignments

TB2	Description	TB2	Description
1	Status Input 1	67	Status Wetting 1 to 64
2	Status Input 2	68	Status Wetting 1 to 64
3	Status Input 3	69	Status Wetting 1 to 64
4	Status Input 4	70	Status Wetting 1 to 64
5	Status Input 5	71	Status Wetting 1 to 64
6	Status Input 6	72	Status Wetting 1 to 64
7	Status Input 7	73	Status Wetting 1 to 64
8	Status Input 8	74	Status Wetting 1 to 64
9	Status Input 9	75	Status Wetting 1 to 64
10	Status Input 10	76	Status Wetting 1 to 64
11	Status Input 11	77	Status Wetting 1 to 64
12	Status Input 12	78	Status Wetting 1 to 64
13	Status Input 13	79	Status Wetting 1 to 64
14	Status Input 14	80	Status Wetting 1 to 64
15	Status Input 15	81	Status Wetting 1 to 64
16	Status Input 16	82	Status Wetting 1 to 64
17	Status Input 17	83	Status Wetting 1 to 64
18	Status Input 18	84	Status Wetting 1 to 64
19	Status Input 19	85	Status Wetting 1 to 64
20	Status Input 20	86	Status Wetting 1 to 64
21	Status Input 21	87	Status Wetting 1 to 64
22	Status Input 22	88	Status Wetting 1 to 64
23	Status Input 23	89	Status Wetting 1 to 64
24	Status Input 24	90	Status Wetting 1 to 64
25	Status Input 25	91	Status Wetting 1 to 64
26	Status Input 26	92	Status Wetting 1 to 64
27	Status Input 27	93	Status Wetting 1 to 64
28	Status Input 28	94	Status Wetting 1 to 64
29	Status Input 29	95	Status Wetting 1 to 64
30	Status Input 30	96	Status Wetting 1 to 64
32	Status Input 32	98	Status Wetting 1 to 64
33	Status Input 33	99	Status Wetting 1 to 64
34	Status Input 34	100	Status Wetting 1 to 64

TB2	Description	TB2	Description
35	Status Input 35	101	Status Wetting 1 to 64
36	Status Input 36	102	Status Wetting 1 to 64
37	Status Input 37	103	Status Wetting 1 to 64
38	Status Input 38	104	Status Wetting 1 to 64
39	Status Input 39	105	Status Wetting 1 to 64
40	Status Input 40	106	Status Wetting 1 to 64
41	Status Input 41	107	Status Wetting 1 to 64
42	Status Input 42	108	Status Wetting 1 to 64
43	Status Input 43	109	Status Wetting 1 to 64
44	Status Input 44	110	Status Wetting 1 to 64
45	Status Input 45	111	Status Wetting 1 to 64
46	Status Input 46	112	Status Wetting 1 to 64
47	Status Input 47	113	Status Wetting 1 to 64
48	Status Input 48	114	Status Wetting 1 to 64
49	Status Input 49	115	Status Wetting 1 to 64
50	Status Input 50	116	Status Wetting 1 to 64
51	Status Input 51	117	Status Wetting 1 to 64
52	Status Input 52	118	Status Wetting 1 to 64
53	Status Input 53	119	Status Wetting 1 to 64
54	Status Input 54	120	Status Wetting 1 to 64
55	Status Input 55	121	Status Wetting 1 to 64
56	Status Input 56	122	Status Wetting 1 to 64
57	Status Input 57	123	Status Wetting 1 to 64
58	Status Input 58	124	Status Wetting 1 to 64
59	Status Input 59	125	Status Wetting 1 to 64
60	Status Input 60	126	Status Wetting 1 to 64
61	Status Input 61	127	Status Wetting 1 to 64
62	Status Input 62	128	Status Wetting 1 to 64
63	Status Input 63	129	Status Wetting 1 to 64
64	Status Input 64	130	Status Wetting 1 to 64
65	External DI DC Supply (+/-)	131	External DI DC Supply (-/+)
66	No Connection	132	No Connection (PE GND on #10 stud)

D20E-C combination inputs and outputs module

Termination block TB2 is a two-tier terminal block. See Table 26 for the terminal block assignments.



The wiring connected to terminal block TB2 must not have exposed accessible conductors.

The wire and cable connected must have at least a +80 °C temperature rating.

Table 26: D20E-C - combination input/output module terminal block assignment

TB2	Descriptions	TB2	Descriptions
1	External Digital Input/Control Output (DPST) DC Supply +/-	51	External Digital Input/Control Output DC Supply -/+
2	External Control Output (T/C and R/L) DC Supply +/-	52	Trip 1/Raise 4/ Normal Open 1/DO1+
3	Close 1/Common 1/DO1-	53	Normal Close 1
4	Trip 2/Lower 4/ Normal Open 2/DO2+	54	Close 2/Common 2/DO2-
5	Normal Close 2	55	Trip 3/Raise 3/ Normal Open 3/DO3+
6	Close 3/Common 3/DO3	56	Normal Close 3
7	Trip 4/Lower 3/Normal Open 4/DO4+	57	Close 4/Common 4/DO4-
8	Normal Close 4	58	Trip 5/Raise 2/ Normal Open 5/DO5+
9	Close 5/Common 5/DO5-	59	Normal Close 5
10	Trip 6/Lower 2/Normal Open 6/DO6+	60	Close 6/Common 6/DO6-
11	Normal Close 6	61	Trip 7/Raise 1/ Normal Open 7/DO7+
12	Close 7/Common 7/DO7-	62	Normal Close 7
13	Trip 8/Lower 1/Normal Open 8/DO8+	63	Close 8/Common 8/DO8-
14	Normal Close 8	64	Analog 1+
15	Analog 1-	65	Shield/Screen Ground
16	Analog 2+	66	Analog 2-
17	Analog 3+	67	Analog 3-
18	Shield/Screen Ground	68	Analog 4+
19	Analog 4-	69	Analog 5+
20	Analog 5-	70	Shield/Screen Ground
21	Analog 6+	71	Analog 6-
22	Analog 7+	72	Analog 7-
23	Shield/Screen Ground	73	Analog 8+
24	Analog Input 8-	74	Analog 9+
25	Analog 9-	75	Shield/Screen Ground
26	Analog 10+	76	Analog 10-
27	Analog 11+	77	Analog 11-
28	Shield/Screen Ground	78	Analog 12+
29	Analog 12-	79	Analog 13+
30	Analog 13-	80	Shield/Screen Ground
31	Analog 14+	81	Analog 14-
32	Analog 15+	82	Analog 15-
33	Shield/Screen Ground	83	Analog 16-
34	Analog 16+	84	Status Wetting 1to 16
35	Status Input 1	85	Status Wetting 1to 16

TB2	Descriptions	TB2	Descriptions
36	Status Input 2	86	Status Wetting 1to 16
37	Status Input 3	87	Status Wetting 1to 16
38	Status Input 4	88	Status Wetting 1to 16
39	Status Input 5	89	Status Wetting 1to 16
40	Status Input 6	90	Status Wetting 1to 16
41	Status Input 7	91	Status Wetting 1to 16
42	Status Input 8	92	Status Wetting 1to 16
43	Status Input 9	93	Status Wetting 1to 16
44	Status Input 10	94	Status Wetting 1to 16
45	Status Input 11	95	Status Wetting 1to16
46	Status Input 12	96	Status Wetting 1to16
47	Status Input 13	97	Status Wetting 1to16
48	Status Input 14	98	Status Wetting 1to16
49	Status Input 15	99	Status Wetting 1to16
50	Status Input 16	100	No Connection

D20E-C module digital inputs

The D20E-C allows up to 16 status inputs. The field terminations for:

- Status inputs are assigned from TB2-35 to TB2-50 and
- Dry contact wetting common are assigned from TB2-84 to TB2-99
- External digital input supply connections on TB2-1 (+/-) and TB2-51 (-/+)

Termination block TB2 is a two-tier block where TB2-35 and TB2-84 are physically located one above the other.

See Table 26 for the terminal block assignments.

D20E-C module analog inputs

The D20E-C supports up to 16 differential analog inputs. The field terminations for analog input are provided by TB2-15 to TB2-34 and TB2-64 to TB2-83.

See Table 26 for termination block details.

One shield termination is allocated for two adjacent inputs. See Table 26 for the terminal block assignments.

D20E-C module control outputs

The D20E-C has 10 on-board relays that are factory configured into a variety of output types; see Table 27 for connection details.

See Table 26 for termination block details.

The W1 to W12 jumpers are located on the D20E-K as shown in Figure 24.

Figure 24: D20E-C module - jumper locations

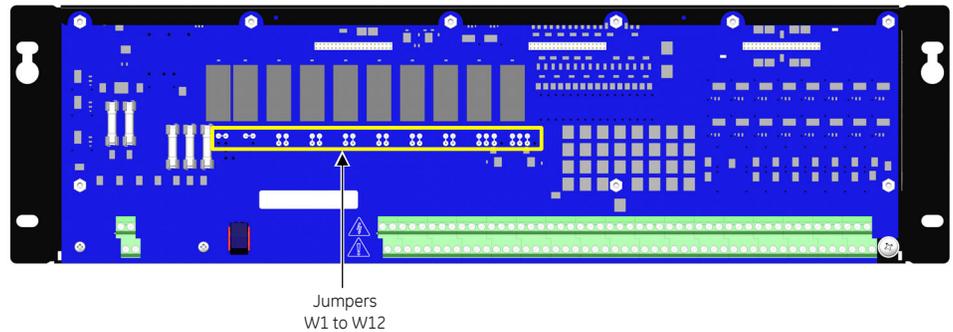


Table 27: D20E-C - summary of control types and jumper setting positions

Control Type	Jumper and Supply	Setting
Trip/Close Trip/Close supply TB2-2(+/-) and TB2-51(-/+) LOCAL/REMOTE Switch supply: TB2-1(+/-) and TB2-51(-/+)	W3-W9, W11	
	W1 and W2	
DPST Control Output supply TB2-1(+) and TB2-51(-)	W3-W9, W11	
	W1 and W2	
Form C LOCAL/REMOTE Switch supply: TB2-1(+/-) and TB2-51(-/+)	W3-W9, W11	
	W10 and W12	
Raise/Lower R/L supply TB2-2 (+/-) and TB2-51 (-/+) LOCAL/REMOTE Switch supply: TB2-1(+/-) and TB2-51(-/+)	W3-W9, W11	
	W1	
	W2	

D20E-C module - control output external supply

The control output supply must be provided from an external supply. The supply connections must be made on:

- TB2-2(+/-) and TB2-51(-/+) for either Trip/Close or Raise/Lower outputs
- TB2-1(+/-) and TB2-51(-/+) for DPST or outputs, and facilitate the Remote/Local switch for all output types.

See Table 26 for termination block details.

D20E-C module - Local/Remote switch

The remote/local switch (S1) disables the operation of control outputs when in the local position. Both the external control output supply and the control relays are disabled by switch S1 when in the local position.

The switch is located between TB1 and TB2.

D20E-C module - Trip/Close control outputs

Trip/Close control outputs require the closing of two relays before voltage appears on the control output. The two relays must be one of the Master Trip or Master Close and the associated select relay for the control output to be operated. Having both the Master Trip and Master Close relay switching on simultaneously is not allowed and is prevented by the D20E-C.

See Table 26 for termination block details.

Figure 19 shows the Trip/Close control output path. For the Trip/Close configuration the control supply is connected between on TB2-2 for positive and TB2-51 for negative. 8 dual Trip/Close outputs are supported on the D20E-C.

D20E-C module - DPST control outputs

The Double Pole Single Throw (DPST) outputs require only one relay to be energized to perform a control. Both supply polarity leads are switched. Figure 22 shows the DPST control output path.

DPST outputs are shown as DO(+/-) in Table 26.

There are 8 single DPST outputs available on the D20E-C.

D20E-C module - Form C control outputs

The Form C control is a dry contact output. The control uses 2 complementary contacts:

- One normally open, and
- One normally closed.

There are 8 Form C control outputs that can be configured on the D20E-C. Figure 20 shows the Form C output contacts.

D20E-C module - Raise/Lower control outputs

A Raise/Lower control uses either a raise relay or a lower relay to increment or decrement a value (i.e.: tap changer).

Each Raise/Lower set uses two control output select relays:

- One for the raise and
- One for the lower.

This provides support for 4 Raise/lower control outputs using 8 select relays on the D20E-C. Figure 21 shows the Raise/Lower output configuration.

D20E Ethernet I/O Module

Chapter 8: Powering-up and Testing a D20E Module

This chapter describes how to test for proper operation of a D20E module:

- [Prerequisites](#) on page 101
- [Power up procedure](#) on page 102
- [Test your field I/O](#) on page 102

Prerequisites

Prior to testing of the D20E module, the following tasks must be complete:

1. Earth ground has been connected; see chapter: [Preliminary Power Up and Test](#) on page 83.
2. Field wiring has been completed; see sections:
 - [D20E-A analog inputs module](#) on page 87,
 - [D20E-K control outputs module](#) on page 89,
 - [D20E-S digital inputs module](#) on page 95, and
 - [D20E-C combination inputs and outputs module](#) on page 97
3. Communication connections have been made; see chapter: [Connecting to Devices and Networks](#) on page 77.
4. Firmware has been configured; see chapter: [Configuring the D20E Firmware](#) on page 37.

In addition, DAPserver Studio must be on-hand.

You are now ready to power-up the D20E module and verify that the D20E module is functioning properly.

Power up procedure

To power up and test the D20E module:

1. Turn on the Substation Controller or Computer.
2. Turn on the power source to the D20E module.
3. Verify that the D20E module LEDs indicate normal operation, as follows:

Label	Color	Normal operation
DC1	Blue	On solid when power supply 1 input is present
DC2	Blue	On solid when power supply 2 input is present
ON	Red	On solid when D20E module power supply output is present
RUN	Red	CPU is operating properly, 1sec ON/OFF after restart initialization

For information on the operation of all LED indicators, see chapter: [Using the D20E Module](#) on page 103.

Test your field I/O

Test your D20E module inputs or outputs, as appropriate for your substation automation system.

Refer to the manual for your substation automation system. For example:

- D400 Substation Gateway Instruction Manual (994-0089)
- D20MX Substation Controller Instruction Manual (994-0140)

For information on the operation of all LED indicators, see chapter: [Using the D20E Module](#) on page 103.

To test previously configured input/output points using DAPserver Studio:

1. Go to the **Device** menu > **Explore** tab view.
2. Click on the desired PROVIDERS device name.
3. Click on the Device icon in the upper-left of the main window.
4. Click on one of the following input/output types on the left side of the main window pane under Health:
 - Digital Input
 - Digital Output
 - Analog Input
 - Counter
5. Verify the D20E module operation of inputs or outputs by sending a DO command or reading the status of a DI and AI point through DAPserver Studio > Explorer.

D20E Ethernet I/O Module

Chapter 9: Using the D20E Module

This chapter describes the D20E module labels, LEDs and connectors for the:

- [Side panel](#) on page 104
- [Front panel](#) on page 105

Some front panel elements are common to multiple D20E module types:

- [LEDs common to all D20E module types](#) on page 105
- [Module remote/local switch](#) on page 105
- [Terminal block connector summary](#) on page 105

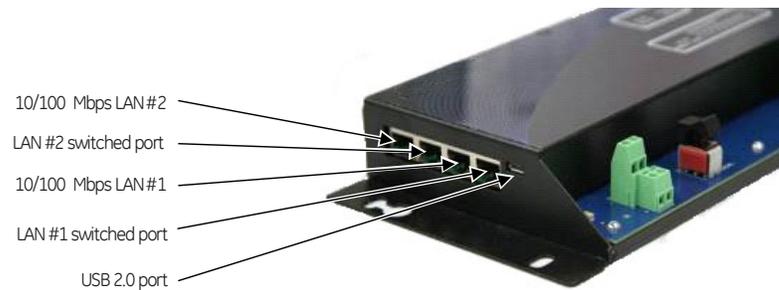
Some front panel elements are unique to each D20E module type:

- [D20E-K module front panel](#) on page 106
- [D20E-A module front panel](#) on page 108
- [D20E-S module front panel](#) on page 109
- [D20E-C module front panel](#) on page 110

Side panel

The side panel LEDs and connectors (see Figure 25) are common to all D20E module types.

Figure 25: Side panel elements



Connectors on the D20E module side panel provide Ethernet connection and a micro USB serial port; see Table 28.

Table 28: Side panel connectors

Function	DAPserver Studio		Description
	Designation	Default IP address	
LAN 1 Ethernet port	Eth 0	192.168.0.189 (Active)	Identified as eth0/1 in DAPserver Studio. This is a bridged pair of RJ45 10/100BaseT ports, where each port has a separate MAC address.
LAN 2 Ethernet port	Eth 1	192.168.1.189 (Active)	
Micro USB 2.0 serial port			Accessed by using a USB-to-Micro USB cable between a PC and the D20E module for console maintenance.

LEDs on the D20E module side panel indicate the status of LAN1 and LAN2 Ethernet connections; see Table 29.

Table 29: D20E Ethernet connection status LEDs

LED Indicator	Color	Description
RJ45 LAN 1 and 2	Green	LINK
	Yellow	ACTIVITY

Front panel

LEDs common to all D20E module types

The Power Supply LEDs on the D20E module front panel indicate the power supply and operation status (see Table 30).

These LEDs apply to all D20E modules.

Table 30: D20E power supply and operation status LEDs

LED Indicator	Color	Description
DC1	Blue	DC1 power supply input 1 is present
DC2	Blue	DC2 power supply input 2 is present
ON	Red	D20E power supply output (5 VDC/3.3 VDC) is present
RUN	Red	CPU operating properly, 1sec ON/OFF after restart initialization

Module remote/local switch

The remote/local switch (S1) operation is described in Table 31.

This switch applies to the following modules:

- D20E-K
- D20E-C

Table 31: Remote/Local switch

Switch label	Description
LOCAL	Select local mode to disable the operation of control outputs.
REMOTE	Select remote to enable the operation of control outputs.

See section: [Remote/Local switch](#) on page 90 for details.

Terminal block connector summary

TB2 connectors

The number of available inputs/outputs on the TB2 terminal block for each D20E module type is indicated in Table 32.

Table 32: TB2 connectors - input/output summary

Field connection type	Number of I/O connections on module type			
	D20E-K	D20E-A	D20E-S	D20E-C
Digital Outputs (control)	32			8
Analog Inputs		32		16
Digital Inputs (status)			64	16

For connection details, see chapter: [Connecting Field Wiring to the D20E Module](#) on page 87.

TB1 connectors The TB1 terminal block connector assignments are indicated in Table 33.

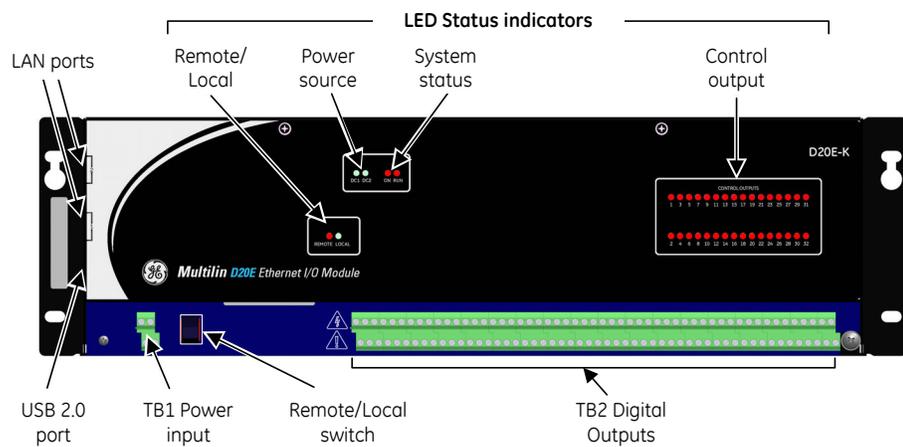
Table 33: TB1 connectors

TB1	Description	TB1	Description
1	Positive External Supply 1 (+)	3	Positive Redundant External Supply 2 (+)
2	Negative External Supply 1 (-)	4	Negative Redundant External Supply 2 (-)

D20E-K module front panel

The location of the D20E-K module front panel key elements and connectors is shown in Figure 26.

Figure 26: D20E-K module front panel elements



D20E-K LEDs

The D20E-K module LEDs are listed in Table 34.

Table 34: D20E control output status LEDs

LED Indicator	Color	Description
REMOTE	Red	Control outputs enabled
LOCAL	Blue	Control outputs disabled
CONTROL OUTPUT 1 to 32	Red	Control output selected 1 to 32 ON

Remote/local switch

The remote/local switch (S1) operation is described in section: [Module remote/local switch](#) on page 105.

D20E-K connectors

For information on Terminal Block 2 (TB2) connector assignments for the D20E-K module, see [D20E-K control outputs module](#) on page 89.

Operate a raise/lower DO point

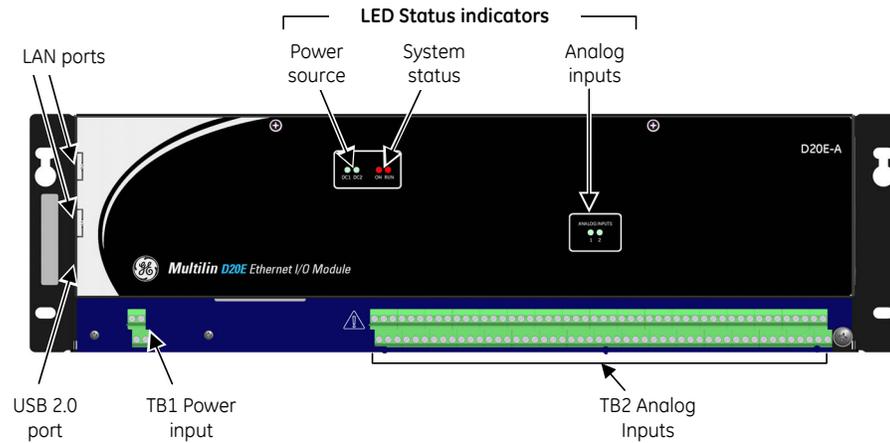
To operate a R/L (raise/lower) Digital Output point:

1. Log in to WESMAINT.
2. Switch to **SYSTEM DATA DISPLAYS > DIGITAL OUTPUT DISPLAY**.
Result: All DO points appear on the WESMAINT screen.
3. Press the UP or DOWN arrow key (to select the R/L DO point) or press **g** to enter the R/L DO point number.
4. Press **Ctrl-f**.
Result: The password prompt appears at the bottom of the WESMAINT screen.
5. Type in the **Password** and then press **Enter**.
6. Press **Ctrl-u**.
Result: The cursor moves to the command type column.
7. Press the space-bar to move to the **Trip/Close** command.
8. Type in the **ON TIME**, **OFF TIME** and the **REPEAT COMMAND** number of repeat times.
9. Press **Enter** again.
Result: The R/L DO point is now active.
10. Repeat this procedure for each required R/L DO point.

D20E-A module front panel

The location of the D20E-A module front panel key elements and connectors is shown in Figure 27.

Figure 27: D20E-A module front panel elements



D20E-A LEDs

The D20E-A module LEDs are listed in Table 35.

Table 35: D20E analog inputs status LEDs

LED Indicator	Color	Description
ANALOG INPUTS - 1 and 2	Blue	Analog Digital Conversion (ADC) processes 1 and 2 for analog inputs.

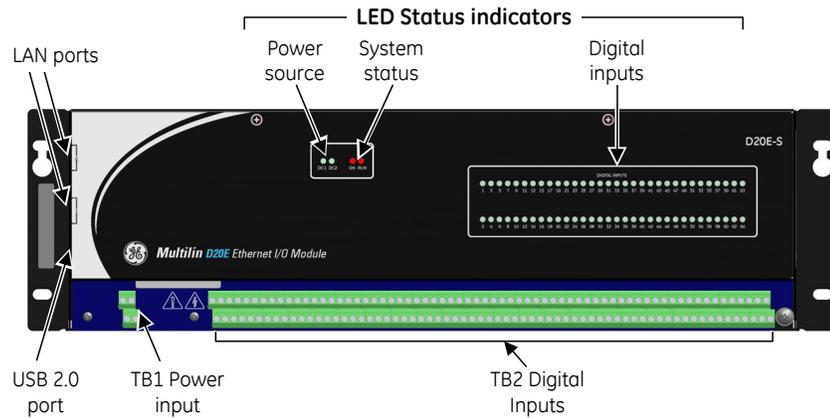
D20E-A connectors

For information on Terminal Block 2 (TB2) connector assignments for the D20E-A module, see [D20E-A analog inputs module](#) on page 87.

D20E-S module front panel

The location of the D20E-S module front panel key elements and connectors is shown in Figure 28.

Figure 28: D20E-S module front panel elements



D20E-S LEDs

The D20E-S module LEDs are listed in Table 36.

Table 36: D20E-S digital input status LEDs

LED Indicator	Color	Description
DIGITAL INPUT 1 to 64	Blue	Digital input 1 to 64 ON

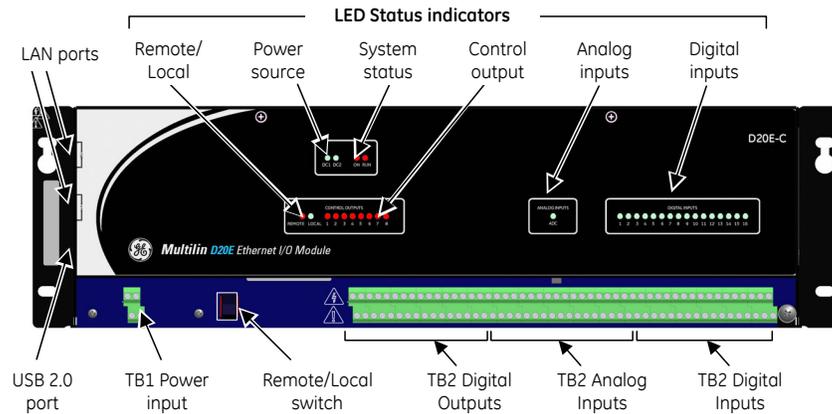
D20E-S connectors

For information on Terminal Block 2 (TB2) connector assignments for the D20E-S module, see [D20E-S digital inputs module](#) on page 95.

D20E-C module front panel

The location of the D20E-C module front panel key elements and connectors is shown in Figure 29.

Figure 29: D20E-C module front panel elements



D20E-C LEDs

The D20E-C module LEDs are listed in Table 37.

Table 37: D20E-C status LEDs

LED Indicator	Color	Description
ANALOG INPUTS - ADC	Blue	Analog input digital conversion process
DIGITAL INPUT 1 to 16	Blue	Digital input 1 to 16 ON
CONTROL OUTPUT 1 to 8	Red	Control output selected 1 to 8 ON

Remote/local switch

The remote/local switch (S1) operation is described in section: [Module remote/local switch](#) on page 105.

D20E-C connectors

For information on Terminal Block 2 (TB2) connector assignments for the D20E-C module, see [D20E-C combination inputs and outputs module](#) on page 97.

D20E Ethernet I/O Module

Chapter 10: Maintaining a D20E Module Firmware

This chapter describes how to perform the following firmware maintenance tasks:

- [Upgrade project](#) on page 111
- [Update firmware](#) on page 111
- [Reset device communication protocol and point mapping](#) on page 113

Upgrade project

To upgrade a project to the new DAPserver Studio firmware version:

1. Open the project; see section: see [Open a project](#) on page 47.
2. Save the project; see section: see [Save a project](#) on page 48.

Result: The D20E module automatically restarts when the Sync project update is complete.

Update firmware

The D20E firmware is distributed with DAPserver Studio. When a new release of DAPserver Studio is installed on the Windows PC, the latest firmware is available to be downloaded to the D20E module. Each D20E module is delivered with the most recent firmware version; subsequently this process is not required on a new product.



NOTE

The DAPserver Studio version should match the firmware on the D20E module. If the D20E is running a firmware version that is older than the DAPserver Studio software version, DAPserver Studio may not connect (communicate) with the older D20E firmware device. However, most older firmware versions on the D20E will connect to the latest DAPserver Studio.

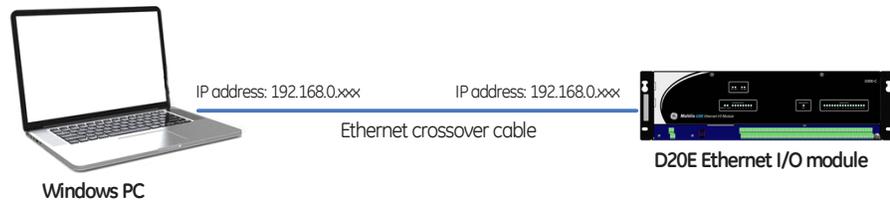


NOTE

Always use the latest version of DAPserver Studio.

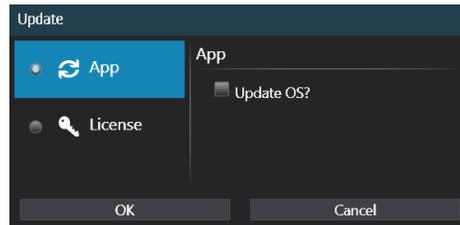
If it is necessary to update the D20E module firmware:

1. Power up the D20E module.
2. Connect the D20E module to the DAPserver Studio (running on a Windows PC) via the LAN port.



3. Select **Update** from the **Device** menu tab.
Result: The Device Information window appears.
4. Type in the **IP Address** of the D20E module.
5. Type in the **Username** and **Password** login credentials (default: **admin**).
6. Click **OK**.

Result: The Update window appears.



7. Select the update to include:
 - **Application** update
 - Application - **update OS**. It is necessary to update the OS as well for a D20E Ethernet I/O Module.
8. Click **OK**.

Result: The Updating ... window appears, showing the progress of the firmware download.

Result: The D20E module automatically restarts after a successful download, in order for the new firmware to take effect.

9. When the D20E module restart is complete, reconnect to the D20E module:
 - 9.1. Open the **Device** menu bar.
 - 9.2. Click **Explore**.
Result: Explorer opens.

10. Check that the firmware version and point status are all in a good state.
You cannot downgrade to an older firmware version.

Reset device communication protocol and point mapping

In the event that it is necessary to reset the communication protocol and point mapping on a D20E device to the factory settings, you need to load the D20E device template.

If a D20E device is connected to:

- A GE Grid Solutions D2x (for example, D20ME, iBOX, D25), D20MX, D400, or DMC490 device, **only use the device template files provided on the D20E Doc CD.**
If you restore the D20E to the template files available on DAPserver Studio, the communications protocol settings will not be correct for connection to D20, D20MX, D400, or DMC490 devices.
- For any other device, restore the factory settings from the device templates provided on DAPserver Studio.

D20E Ethernet I/O Module

Chapter 11: Servicing the D20E Module Hardware

This chapter describes physical maintenance and service:

- [Performing periodic inspection](#) on page 116
- [Preventative maintenance](#) on page 116
- [Rebooting the D20E](#) on page 116
- [Fuse replacement](#) on page 116
- [DIP switch settings](#) on page 117

The D20E Ethernet I/O Modules do not require scheduled component or board level maintenance or replacement.

Some maintenance tasks impact the D20E module firmware:

- [Firmware update](#) on page 118
- [Clock setting](#) on page 118
- [Time synchronization](#) on page 118

Performing periodic inspection

Periodic inspection is recommended to ensure that:

- The D20E module has not sustained accidental physical damage.
- Connectors and cables are intact and firmly attached.
- LED indications are functional.

Preventative maintenance

Preventative maintenance such as cleaning dust may be required. This can be done by wiping off the surface using a slightly damp clean cloth when the module has all external supplies de-energized.

Rebooting the D20E

Sometimes it is necessary to reboot (restart) the D20E module. A reboot can be performed by any of the following:

- Power cycling the D20E module. That is, remove and reconnect the power to the D20E.
- Executing the Sync command. The D20E reboots automatically when a Task bar > Sync command is selected.
- Manually force point 16, **Reboot Device** from the **Explore** screen > **Health** table.
- Executing the Linux command **Shutdown -r now** command with a Windows PC connected to the mini USB port.

Fuse replacement

The D20E modules are equipped with on-board 5x20mm fuses.

To replace a fuse:

1. Remove the top logic board.

Use ESD handling precautions when removing and installing the top Logic board.

2. Locate the fuses on the bottom of the D20E module Interface board.
3. Replace any fuses with the appropriate fuses listed in Table 38.
4. Replace the top logic board.

To prevent damage to the D20E module:

- Use extra care when aligning the top Logic board with the bottom Interface board connectors.
- Use the stand-off mounting holes as a locator guide before carefully and slowly pushing down on the Logic board

NOTICE

NOTICE

Table 38: Fuse ratings

Fuse #	Descriptions	Fuse Type
F1	DC+ Power Protection	T500mA 250V (time-delay or slow-blow)
F2	DC- Power Protection	T500mA 250V (time-delay or slow-blow)
D20E-K module		
F3	Control Output +/- Supply	2A 250V (fast-acting)
F4	Control Output -/+ Supply	2A 250V (fast-acting)
D20E-K (DB25) interface		
F3	Control Output +/- Supply	0.5A 250V (fast-acting)
F4	Control Output -/+ Supply	0.5A 250V (fast-acting)
D20E-S module		
F3	Digital Input +/- Supply	0.5A 250V (fast-acting)
F4	Digital Input -/+ Supply	0.5A 250V (fast-acting)
D20E-A module		
F3	Analog Input + Loop Supply	1A 250V (fast-acting)
F4	Analog Input - Loop Supply	1A 250V (fast-acting)
D20E-C module		
F3	Digital Input and Control Output +/- Supply	2A 250V (fast-acting)
F4	Digital Input and Control Output -/+ Supply	2A 250V (fast-acting)
F5	Control Output Supply	2A 250V (fast-acting)

DIP switch settings

The D20E modules have two DIP switches on the internal Logic board assembly:

- **CFG RESET** and
- **WDI**.

NOTICE

These DIP switches are factory set and must not be changed.

Table 39 specifies the DIP switch settings which must be in place in order for the D20E module to operate correctly.

Table 39: DIP switch settings - required

DIP switch	Required switch position
CFG RESET	1-OFF
	2-OFF
	3-OFF
	4-OFF
WDI	1-ON
	2-OFF

NOTICE

Do not press the **CPU RST** or the **K10 Reset** push-button switches. Pressing either of these switches causes the D20E module to reset or restart.

Firmware update

When required, D20E module firmware updates are made available. These updates may provide new functions, new features or improvements.

The D20E Ethernet I/O Module is delivered with a version of DAPserver Studio firmware. Before you can update the configuration of a D20E module, the latest version of DAPserver Studio must be running on the D20E.

Refer to section: [Update firmware](#) on page 111 for the procedure to update the firmware.

Clock setting

The D20E module local clock can be set with a Linux standard command.

To set the clock with a Linux Command:

1. Power up the D20E module.
2. Connect a cable with a USB micro AB plug between a PC and the D20E module USB 2.0 LAN port. See section: [Console port](#) on page 78.
3. Run a terminal emulator program.
4. Connect to the D20E module at **10.0.0.1:22** with **SSH** encryption.
Result: The console prompt appears: #.
5. Execute the date command: # **date -s "25 OCT 2017 10:00:00"**
6. Execute the date command: # **date** to ensure that the clock has been changed.

Time synchronization

The D20E module can be time synchronized with an NTP time source on the network. See section: [Configure NTP time sync](#) on page 50.



NOTE

DO NOT use both DNP and NTP time sync simultaneously.

D20E Ethernet I/O Module

Chapter 12: Removing the D20E from Service

At some point, it may be necessary to remove the configuration data and sensitive information from the D20E (for example, disposal purposes).

It may also be necessary to remove data from a PC that has run DAPserver Studio for the purpose of configuring a D20E Ethernet I/O Module.

When a D20E is to be removed from service, it is necessary to:

- [Remove your configuration data and sensitive information from the D20E](#) on page 119
- [Remove configuration data on a PC](#) on page 120

Remove your configuration data and sensitive information from the D20E

In the event that it is necessary to remove a D20E from your electrical utility system, you will want to remove your configuration data and sensitive information from the D20E.

Removal from the system may be due to:

- Return of device to GE Grid Solutions for maintenance.
- Device disposal

Returning the D20E for maintenance

If the D20E is being returned to GE Grid Solutions for maintenance (that is, RMA), you need to replace your configuration data with default configuration data prior to shipment.

Prerequisites

Prerequisites for removing your configuration data and sensitive information from the D20E:

- A Windows PC running the same version of DAPserver Studio that is running on the D20E.
- An Ethernet cable.

Removal Procedure

To remove configuration data and sensitive information from the D20E:

1. Connect the D20E to a Windows PC running DAPserver Studio.
2. Save your configuration data using DAPserver Studio; see section: [Import an existing project from a device](#) on page 48.
3. Replace the configuration data with the D20E default configuration data available from DAPserver Studio; see section: [Create a project](#) on page 44.

Device disposal

To prevent non-intended use of the unit, remove the modules, dismantle the unit, and recycle the metal when possible.

There are no special requirements for disposal of the unit at the end its service life.

NOTICE

However, GE recommends that you destroy the device (i.e., shred, disintegrate, pulverize, or incinerate by burning the device in a licensed incinerator) as per Draft NIST Special Publication 800-88 Revision 1, Guidelines for Media Sanitization, Recommendations of the National Institute of Standards and Technology:

(http://csrc.nist.gov/publications/drafts/800-88-rev1/sp800_88_r1_draft.pdf).

Remove configuration data on a PC

When a PC application (that is, DAPserver Studio) is used to configure the D20E, configuration data resides on the data storage media (e.g., hard drives, memory cards, etc.) of the PC running the configuration application.

The D20E 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).

D20E Ethernet I/O Module

Appendix A: Standards & Protection

Compliance standards

Compliance standards are listed for the following categories:

- [Table 40: Emission standards](#) on page 121
- [Table 41: Immunity standards](#) on page 121
- [Table 42: Safety publications](#) on page 122
- [Table 43: Environmental standards](#) on page 122
- [Table 44: Communication standards](#) on page 123

Table 40: Emission standards

Standard Name	Description	Test Specification
EN55011 (CISPR 11) ¹	ISM RF equipment – Electromagnetic disturbance characteristics	Radiated Emissions 30 MHz to 1 GHz Conducted Emissions 150 kHz to 30 MHz

¹ To comply, all RS232 cables must be double shielded (that is, foil shield plus braid).

Table 41: Immunity standards

Standard Name	Description	Test Specification
IEC 61000-4-2 IEC 60255-22-2 IEEE® C37.90.3	Electrostatic discharge (ESD) immunity test	8 kV contact 15 kV air discharge
IEC 61000-4-3 IEC 60255-22-3 IEEE C37.90.2 (10 V/m)	Radiated, radio-frequency electromagnetic field immunity test	80 MHz to 1.0 GHz, 10 V/m 1.4 GHz to 2.0 GHz, 3 V/m 2.0 GHz to 2.7 GHz, 1 V/m
IEC 61000-4-4 IEC 60255-22-4 IEEE C37.90.1	Electrical fast transient/burst immunity test	±4.0 kV CM/TM
IEC 61000-4-5	Surge immunity test	±2.0 kV / 4.0 kV TM/CM

Standard Name	Description	Test Specification
IEC 61000-4-6 IEC 60255-22-6	Immunity to conducted disturbances, induced by radio-frequency fields	150kHz to 80 MHz, 10 V _{rms}
IEC 61000-4-8	Power frequency magnetic field immunity test	50/60 Hz, 100 A/m 100 A/m, 1 sec
IEEE C37.90.1	Temperature Testing: Operational Test	
IEEE C37.90.1	Temperature Testing: Non-operational Test	
IEC 61000-4-16	Test for immunity to conducted, common mode disturbances in the frequency range 0 Hz to 150 kHz	DC - 150 kHz CM 3/30 V _{rms}
IEC 61000-4-17	Ripple on DC input power port immunity test	15%
IEC 61000-4-18	Ring wave immunity test	±2.5 kV CM/TM
IEEE C37.90.1 SWC	Damped oscillatory wave immunity test	
IEC 61000-4-29	Voltage dips, short interruptions and voltage variations on DC input power port immunity test	30/60/100% @ 24 VDC

Table 42: Safety publications

Standard Name	Description	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	Insulation Resistance >100 MΩ Insulation Dielectric 0.7/2.8 kVDC Insulation Impulse 1/5 kV _{pk}

Table 43: Environmental standards

Standard Name	Description	Test Specification
IEC 60068-2-1	Cold	2 hours non powered, soak at -40 °C, then warm to -20 °C and leave powered for 16 hours
IEC 60068-2-2	Dry Heat	16 hours powered at +70 °C
IEC 60068-2-6 IEC 60255-21-1	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 IEC 60255-21-2	Shock - Operating Response Test Shock - Non-Operating Withstand Test	Pulse shape: Half sine Pulse duration: 11 mS - 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
	Bump - Non operating test	Pulse shape: Half sine Pulse duration: 11 mS Acceleration level: 10 g's 1000 pulses per polarity per axis for a total of 6000 pulses
IEC 60068-2-31	Drop and topple	Dropping on each face Dropping on each corner Toppling (or pushover) For a total of 12 drops, 50 mm
IEC 60068-2-78	Humidity Testing	96 hours steady state humidity at 40 °C and 93% RH

Table 44: Communication standards

Standard Name	Description	Test Specification
IEEE 802.3	CSMA/CD Access Method (and physical layer specifications)	
IEC 61850-3	Communication networks and systems in substation – General requirements	
IEEE 1613	Environmental and testing Requirements for Communications Network Devices in Substations	

D20E Ethernet I/O Module

Appendix B: DAPserver Studio

DAPserver Studio is the software utility used to:

- Create and apply configurations for D20E devices
- Update the D20E firmware
- Monitor real-time data on the D20E devices
- Retrieve configurations from D20E devices

Screen layout

This section describes the following screen elements that appear in the DAPserver Studio user interface:

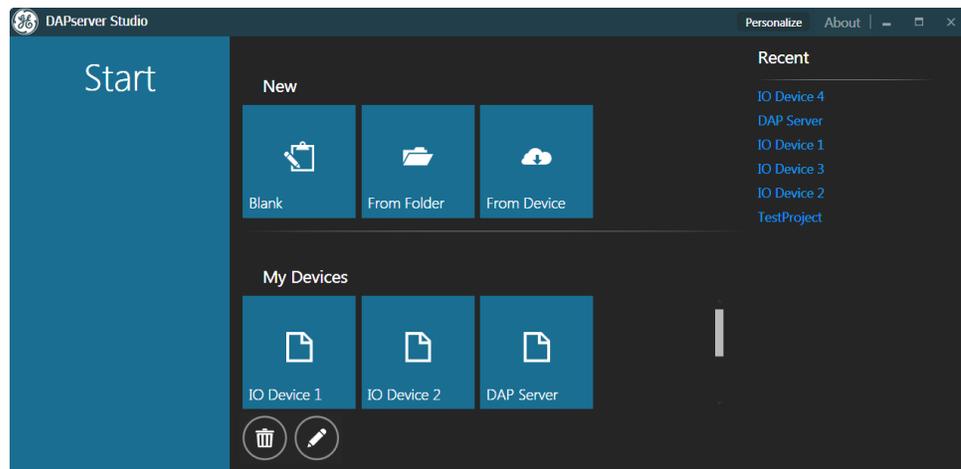
- Main window
 - New
 - My Devices
 - Recent
- Configuration window
 - Window title bar
 - Menu bar
 - Main workspace
 - Task bar

Main window

After installation, and upon opening of DAPserver Studio, the Main window in Figure 30 appears. The icons on the Main window are separated into three categories:

- **New:**
Clicking on the **Blank** or **From Folder** areas allows you to create a new project from a blank template or select an existing project from an existing folder.
- **My Devices:**
Projects that have already been opened or created in the DAPserver Studio appear in this area.
- **Recent:**
Similar to My Devices, a list of project names appears in this area for projects that have recently been worked on.

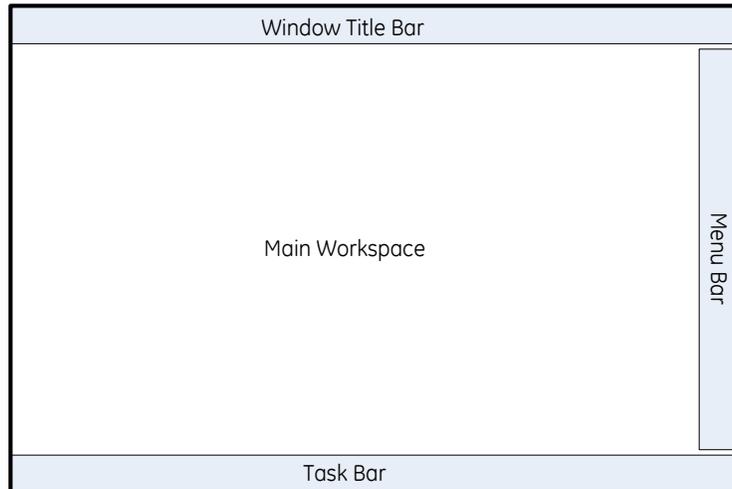
Figure 30: DAPserver Studio - main window



Project configuration window

Once a project has been created or opened, the project window layout shown in Figure 31 appears.

Figure 31: Project - main window



The project configuration window shows the following screen areas:

- Window title bar
- Main workspace
- Menu bar
- Task bar

Window title bar

Table 45 lists the window title bar commands.

Table 45: Header commands

Function	Icon	Description
Close		Standard Window™ commands.
Minimize		
Maximize		
User Login		Permanently save login information, or to just save the login information for the current session.
About		Show the firmware information of D20E

Menu bars

After DAPserver Studio has started, you can access the command menus that appear on the right side of the screen:

- **Device** menu
- **Settings** menu
- **Tools** menu

These menus provide access to multiple options and screens.

Device menu bar

To view the Device menu bar:

1. Select a project.
2. Click **Device** on the far right of the screen.



Result: The Devices menu bar appears with the following items:

- Network
- Time Sync
- Users
- Guard; not applicable to the D20E
- Explore
- Diagnostics; not applicable to the D20E
- Update

Settings menu bar

To view the Settings menu bar:

1. Select a project.
2. Click **Settings** on the far right of the screen.



Result: The Settings menu bar appears with the following items:

- General
- Providers
- Publishers
- Save
- Sync

Tools menu

None of the Tools commands is used in the monitoring or configuring of a D20E.

Main workspace

This is the main workspace area to view the many windows of D20E. As you navigates to these windows using the menu bar, the main workspace content changes depending on the your selection.

Task bar

The task bar is accessible in most of the applications within DAPserver Studio. Right-click anywhere in order to open or close this command menu. The menu content is context-sensitive; that is, only the appropriate commands appear for the current active window. For example, the task bar can appear as:



See the DAPserver Studio User Guide for details on each task bar command.

D20E Ethernet I/O Module

Appendix C: D20E Module DNP3 Server Profile

This appendix provides:

- [DNP3 IED protocol document](#) on page 129
- [DNP3 object implementation table](#) on page 131

DNP3 IED protocol document

The following document is provided for information purposes.

D20E DNP3 Server			
Vendor Name:		GE Grid Solutions	
Device Name:		D20E Ethernet I/O Module	
Highest DNP Level Supported:		Device Function:	
	For Requests	Level 2	<input type="checkbox"/> Master <input checked="" type="checkbox"/> Slave
:	For Responses	:Level 2	
<ul style="list-style-type: none"> • Notable objects, functions, and/or qualifiers supported in addition to the highest DNP levels supported (the complete list is described in the attached table): 			
Maximum Data Link Frame Size (octets):		Maximum Application Fragment Size (octets):	
	Transmitted	292	Transmitted 2048
	Received	292 (must be 292)	Received 2048 (must be > 249)
Maximum Data Link Retries:		Maximum Application Layer Retries:	
<input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input checked="" type="checkbox"/> Configurable, range 0 to 255		<input type="checkbox"/> None <input checked="" type="checkbox"/> Configurable, range, 0 to 255	
Requires Data Link Layer Confirmation:			
<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable		If 'Sometimes', when? _____ If 'configurable', how? _____	
Requires Application Layer Confirmation:			
<input checked="" type="checkbox"/> Never <input type="checkbox"/> Always (not recommended)			

D20E DNP3 Server	
<input checked="" type="checkbox"/> When reporting Event Data (Slave devices only) <input checked="" type="checkbox"/> When sending multi-fragment responses (Slave devices only) <input type="checkbox"/> Sometimes If 'Sometimes', when? _____ <input checked="" type="checkbox"/> Configurable If 'configurable', how? _____	
Timeouts while waiting for:	
Data Link Confirm	<input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input checked="" type="checkbox"/> Configurable
Complete Appl. Fragment	<input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable
Configurable Application Confirm	<input type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input checked="" type="checkbox"/> Configurable
Complete Appl. Response	<input checked="" type="checkbox"/> None <input type="checkbox"/> Fixed at _____ <input type="checkbox"/> Variable <input type="checkbox"/> Configurable
Others	
<ul style="list-style-type: none"> • Attach explanation if 'Variable' or 'Configurable' was checked for any timeout 	
Sends/Executes Control Operations:	
WRITE Binary Outputs	<input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
SELECT/OPERATE	<input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
DIRECT OPERATE	<input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
DIRECT OPERATE - NO ACK	<input type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
Count > 1	<input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
Pulse On	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Pulse Off	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Latch On	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Latch Off	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Queue	<input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
Clear Queue	<input checked="" type="checkbox"/> Never <input checked="" type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
<ul style="list-style-type: none"> • Attach explanation if 'Sometimes' or 'Configurable' was checked for any operation. 	
Counter Freeze/Freeze Reset Operations: (Obj.20, Function Code: 7,8,9,10, Qualifier, 0x00, 0x06)	
Freeze Counter Points	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Freeze (All)	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Freeze and Clear	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Freeze and Clear (All)	<input type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input checked="" type="checkbox"/> Configurable
Freeze with Time	<input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
Freeze with Time (All)	<input checked="" type="checkbox"/> Never <input type="checkbox"/> Always <input type="checkbox"/> Sometimes <input type="checkbox"/> Configurable
<ul style="list-style-type: none"> • Attach explanation if 'Sometimes' or 'Configurable' was checked for any operation. 	
Expects Binary Input Change Events:	
<input type="checkbox"/> Either time-tagged or non-time-tagged for a single event <input type="checkbox"/> Either time-tagged and non-time-tagged for a single event <input checked="" type="checkbox"/> Configurable (attach explanation)	
Cold Restart Function:	Warm Restart Function:
<input type="checkbox"/> None <input checked="" type="checkbox"/> Configurable	<input type="checkbox"/> None <input checked="" type="checkbox"/> Configurable
Sends Multi-Fragment Responses:	
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

DNP3 object implementation table

The information listed in Table 46 indicates the following:

- A blank in the **Response** column indicates that the DNP3 Server does not support the object number and variable number combination. The DNP3 Server only supports the combination that is in accordance with the object number, variable number and qualified codes listed in the table.
- A **Y** in the **Used** column indicates that the DNP3 Server either:
 - Processes the combination of this object number and variable number, or
 - Ignores the combination.
- The **bold** font indicates the type of request that the DNP3 Server is able to send.
- The regular font (not bold) indicates the type of response message the DNP3 Client is able to process.

Table 46: Object implementation table

Object			Request (see Table 48)		Response (see Table 49)	
Number	Variable	Description	FC (hex)	Qualifier (hex)	FC (hex)	Used
1	0	Binary Input - All Variations	1	All valid		
1	1	Binary Input	1		81,82	Y
1	2	Binary Input with Status	1		81,82	Y
2	0	Binary Input Change - All Variations	1	All valid		
2	1	Binary Input Change without Time	1		81,82	Y
2	2	Binary Input Change with Time	1		81,82	Y
2	3	Binary Input Change with Relative Time	1		81,82	Y
3	0	Double Binary Input - All Variations	1	All valid		
3	1	Double Binary Input - Packed format	1		81,82	Y
3	2	Double Binary Input - with flags	1		81,82	Y
4	0	Double Binary Input change - All Variations	1	All valid		
4	1	Double Binary Input change - without Time	1		81,82	Y
4	2	Double Binary Input change - with Time	1		81,82	Y
4	3	Double Binary Input change - with Relative Time	1		81,82	Y
10	0	Binary Output Status - All Variations	1	All valid		
10	1	Binary Output	1		81,82	Y
10	2	Binary Output - with Status	1		81,82	Y
12	0	Binary Control Command - All Variations				
12	1	Control Relay Block	3,4,5,6	17,28,39		Y
12	2	Pattern Control Block	1			N
12	3	Pattern Mask	1			N
13	0	Control Command Event - All Variations	1			N
13	1	Control Command Event - Command Status	1			N
13	2	Control Command Event - T.T Command Status	1			N
20	0	Binary Counter - All Variations	1	All valid		
20	1	32-Bit Binary Counter	1		81,82	Y
20	2	16-Bit Binary Counter	1		81,82	Y
20	3	32-Bit Delta Counter	1		81,82	Y
20	4	16-Bit Delta Counter	1		81,82	Y

Object			Request (see Table 48)		Response (see Table 49)	
Number	Variable	Description	FC (hex)	Qualifier (hex)	FC (hex)	Used
20	5	32-Bit Binary Counter without flag	1		81,82	Y
20	6	16-Bit Binary Counter without flag	1		81,82	Y
20	7	32-Bit Delta Counter without flag	1		81,82	Y
20	8	16-Bit Delta Counter without flag	1		81,82	Y
21	0	Frozen Counter - All Variations	1	All valid		
21	1	32-Bit Frozen Counter	1		81,82	Y
21	2	16-Bit Frozen Counter	1		81,82	Y
21	3	32-Bit Frozen Delta Counter	1		81,82	Y
21	4	16-Bit Frozen Delta Counter	1		81,82	Y
21	5	32-Bit Frozen Counter with Time	1		81,82	Y
21	6	16-Bit Frozen Counter with Time	1		81,82	Y
21	7	32-Bit F-Delta Counter with Time	1		81,82	Y
21	8	16-Bit F-Delta Counter with Time	1		81,82	Y
21	9	32-Bit Frozen Counter without flag	1		81,82	Y
21	10	16-Bit Frozen Counter without flag	1		81,82	Y
21	11	32-Bit F-Delta Counter without flag	1		81,82	Y
21	12	16-Bit F-Delta Counter without flag	1		81,82	Y
22	0	Binary Counter Change - All Variations	1	All valid		
22	1	32-Bit Binary Counter Change	1		81,82	Y
22	2	16-Bit Binary Counter Change	1		81,82	Y
22	3	32-Bit Delta Counter Change	1		81,82	Y
22	4	16-Bit Delta Counter Change	1		81,82	Y
22	5	32-Bit Binary Counter Change without flag	1		81,82	Y
22	6	16-Bit Binary Counter Change without flag	1		81,82	Y
22	7	32-Bit Delta Counter Change without flag	1		81,82	Y
22	8	16-Bit Delta Counter Change without flag	1		81,82	Y
23	0	Frozen Counter Change - All Variations	1	All valid		
23	1	32-Bit Frozen Counter Change	1		81,82	Y
23	2	16-Bit Frozen Counter Change	1		81,82	Y
23	3	32-Bit Delta Frozen Counter Change	1		81,82	Y
23	4	16-Bit Delta Frozen Counter Change	1		81,82	Y
23	5	32-Bit Frozen Counter Change without flag	1		81,82	Y
23	6	16-Bit Frozen Counter Change without flag	1		81,82	Y
23	7	32-Bit Delta Frozen Counter Change without flag	1		81,82	Y
23	8	16-Bit Delta Frozen Counter Change without flag	1		81,82	Y
30	0	Analog Input - All Variations	1	All valid		
30	1	32-Bit Analog Input	1		81,82	Y
30	2	16-Bit Analog Input	1		81,82	Y
30	3	32-Bit Analog Input without flag	1		81,82	Y
30	4	16-Bit Analog Input without flag	1		81,82	Y
30	5	Short Floating	1		81,82	Y
32	0	Analog Input Event - All Variations	1	All valid		
32	1	32-Bit Analog Input Event without Time	1		81,82	Y
32	2	16-Bit Analog Input Event without Time	1		81,82	Y
32	3	32-Bit Analog Input Event with Time	1		81,82	Y

Object			Request (see Table 48)		Response (see Table 49)	
Number	Variable	Description	FC (hex)	Qualifier (hex)	FC (hex)	Used
32	4	16-Bit Analog Input Event with Time	1		81,82	Y
32	5	Short Floating	1		81,82	Y
32	6	Long Floating	1		81,82	Y
32	7	Short Floating with Time	1		81,82	Y
50	0	Time and Date - All Variation	1			
50	1	Time and Date	2		81	Y
50	2	Time and Date with interval	2		81	
50	3	Last Recoded Time	2		81	
51	0	Time and Date Common Time-of-Occurrence	1			Y
51	1	Time and Date CTO	1		81	Y
51	2	Time and Date CTO with interval	1		81	N
51	3	Last Recoded Time CTO	1		81	N
52	0	Delay Measurement - All Variation	17			
52	1	Delay Measurement - Time Delay Coarse	17		81	Y

The request qualifiers (see Table 47) cover the:

- Basic qualifier of all ranges
- Start/stop range of 0x06, 0x00, 0x01;0x02
- Counting range 0x07,0x08 and 0x09
- List range of 0x17, 0x28 and 0x39

Table 47: Qualifier used in DNP3 subset definition

Qualifier	Use in Request	Used in Response
0x00, 0x01,0x02	A range of static points, or a single point with a point, where: <ul style="list-style-type: none"> • 0x00 - 8-bit start and stop indices; • 0x01 - 16-bit start and stop indices; • 0x02 - 32-bit start and stop indices; 	Static objects.
0x06	All points	Not valid
0x07, 0x08,0x09	A limited quantity of events (count beginning with 0). A single point with no number (e.g., Time and Data).	A single point with no number (e.g. Time and Date)
0x17, 0x28,0x39	Control and list of points (usually one or more unrelated points). For point: <ul style="list-style-type: none"> • #1 to #255 use 0x17; • #256 to use 0x28; • #655356 	Event objects (usually one or more unrelated points)

Table 48: DNP3 Function Codes - Requests

Requests (Hex)	
0. Confirm	11. Start application
1. Read	12. Stop application
2. Write	13. Save Configuration
3. Select	14. Enable unsolicited
4. Operate	15. Disable unsolicited
5. Direct Operate	16. Assign class
6. Direct Operate - No Ack	17. Delay measurement
7. Freeze	18. Record current time
8. Freeze - No Ack	19. Open file
9. Freeze Reset	1A. Close file
A. Freeze Reset - No Ack	1B. Delete file
B. Freeze at Time	1C. Get file information
C. Freeze at Time - No Ack	1D. Authenticate file
D. Clod restart	1E. Abort file
E. Warm Restart	1F. Activate configuration
F. Initialize data	20. Authentication request
10. Initialize application	21. Authentication error

Table 49: DNP3 Function Codes - Responds

Responds (Hex)	
81. Response	83. Authentication response
82. Unsolicited response	

D20E Ethernet I/O Module

Appendix D: Miscellaneous

This appendix provides the warranty and revision history.

Warranty

GE Grid Solutions warrants the D20E Ethernet I/O Module product for 10 years. For warranty details including any limitations and disclaimers, see the GE Grid Solutions Terms and Conditions at

<https://www.gegridsolutions.com/multilin/warranty.htm>

Revision history

Version	Revision	Date	Change Description
1.00	0	September 13, 2017	Original release of this document is based upon the Alstom DAP IO User Guide, Version 3.0 Revision 1.
	1	October 19, 2017	Corrected one instance of DAPserver Studio version to show v6.0.2-4.
	2	November 28, 2017	Added non-GE power supply requirements to Chapter: Preliminary Power Up and Test.
	3	May 16, 2019	Updated the Safety Precautions and deterioration of electrolytic capacitor content to Storage recommendations section.
	4	May 11, 2022	Added "Notes" in "Configure NTP time sync" topic in Chapter 3. Updated "Time Synchronization" topic in Chapter 11. Added a Q&A in Appendix D.

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Appendix E: List of Acronyms

Acronym Definitions

This Appendix lists and defines the acronyms used in this manual.

Table 50: Acronym list

Acronym	Definition
A	Amperes, unit of measure
AI	Analog Input
ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
AWG	American Wire Gauge, unit of measure
bps	bits per second, unit of measure
CISPR	Special international committee on radio interference
CO	Control Output
COS	Change of State
CPU	Central Processing Unit
CU	Customs Union
DAP	Digital Automation Platform
DI	Digital Input
DNP	Distributed Network Protocol
DPST	Double Pole, Single Throw
EAC	The new mark of conformity for CU (Customs Union) countries
EAP	Electronic Access Point
EMC	Electromagnetic Capability
ESD	ElectroStatic Discharge
ESP	Electronic Security Perimeter
EU	European Union
FS	Full Scale Analog Input
GE	General Electric

Acronym	Definition
HMI	Human Machine Interface (also called Graphical User Interface - GUI)
HVDI	High Voltage Digital Input
Hz	Hertz, unit of measure for frequency
I/O	Input/Output
IEC	International Electro-technical Commission
IED	Intelligent Electronic Device
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
LAN	Local Area Network
LED	Light Emitting Diode
LSB	Least Significant Bit
LVDI	Low Voltage Digital Input
MAC	Media Access Control
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
ms	milliseconds, unit of measure
MSB	Most Significant Bit
NC	Normally Closed
NO	Normally Open
NTP	Network Time Protocol
NVRAM	Non-Volatile Random Access Memory
OS	Operating System
PC	Personal Computer
RMA	Return Merchandise Authorization
RoHS	Restriction of Hazardous Substances
RTC	Real Time Clock
RTU	Remote Terminal Unit
RU	Rack Unit
Rx	Receive
SBO	Select before Operate
SCADA	Supervisory Control and Data Acquisition
SOE	Sequence of Events
SPST	Single Pole, Single Throw
SSH	Secure Shell
SWC	Surge Withstand Capability
T/C	Trip/Close
TB	Terminal Block
TD	Time Delay
Tx	Transmit
USB	Universal Serial Bus
UTC	Coordinated Universal Time
UTP	Unshielded Twisted Pair
VA	Volt Amps, unit of measure
VAC	Volts, Alternating Current, unit of measure
VDC	Volts, Direct Current, unit of measure

D20E Ethernet I/O Module

Appendix F: Frequently Asked Questions

This appendix answers some frequently and commonly asked D20E questions:

- How do you configure the double Digital Input points?
- How do you identify what D20E configuration is currently running?
- How do you configure a Counter?
- How do you set the Analog Input to match the legacy hardware (signed 16 bit integer)?
- How do you operate a R/L (raise/lower) Digital Output point)?
- How do you operate control output points?
- How do you access the system status information?
- How do you access the Event Log?
- How do you test previously configured input/output points using DAPserver Studio?
- How do you setup Time Synchronization?

Questions and answers

Q: How do you configure the double Digital Input points?

A: Refer to section: [Double digital input configuration procedure](#) on page 59 for this configuration procedure.

Q: How do you identify what D20E configuration is currently running?

A: Method 1: To view the firmware version using DAPserver Studio:

1. Go to **Device** menu > **Explore** tab.
Result: The Explore window appears.
2. Scroll down the main (top) window displayed for SYSTEM, REAL-TIME info
3. Observe the information for the **FMWVER** line item.

A: Method 2: To view the identity of the D20E IO Module currently being configured:

1. Open a Web browser.
2. Type in the command: **<ip address>/dapinfo**.

Result: The following device information appears:

Substation Name: You can manually modify a Substation Name from the **General** settings.

DAP Firmware Version:

Softkey: License key:

License Expiry Date:

Version (license):

Enabled DAP Functions:

Enabled Protocols:

Q: How do you configure a Counter?

A: Refer to section: [Configure counter points](#) on page 60 for this configuration procedure.

Q: How do you set the Analog Input to match the legacy hardware (signed 16 bit integer)?

A: Refer to section: [Set Analog Input for D20E IO Calculator function \(example\)](#) on page 68 for this configuration procedure.

To operate a R/L (raise/lower) Digital Output point:

Q: How do you operate a R/L (raise/lower) Digital Output point)?

A: Refer to section: [Operate a raise/lower DO point](#) on page 107 for this configuration procedure.

Q: How do you operate control output points?

A: Refer to section: [Operation of control output points](#) on page 73 for this procedure.

Q: How do you access the system status information?

A: Refer to section: [Check the D20E system status](#) on page 73 for this procedure.

Q: How do you access the Event Log?

A: Refer to section: [Access the Event Log](#) on page 73 for this procedure.

Q: How do you test previously configured input/output points using DAPserver Studio?

A: Refer to section: [Test your field I/O](#) on page 102 for this procedure.

Q: How do you setup Time Synchronization?

A: Use the Time Sync window in DAPserver Studio to enable NTP Client. Also, note that NTP should be used and DO NOT use both DNP and NTP simultaneously.

Refer to section: [Configure NTP time sync](#) on page 50 for this procedure.

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