
PRODUCT GUIDE

COM600F

Distribution automation controller



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COM600F

Distribution automation controller

General description

ABB's COM600F offers a versatile substation management solution. These units are deployed together with protection and control relays and other communication devices to implement smart substation and grid automation solutions in utility and industrial distribution networks. The COM600F performs the combined role of a user interface, communication gateway and an automation platform in a single physical device.

The COM600F incorporates web technology for substation devices and processes via a web browser based human machine interface (HMI). All standard substation monitoring and control aspects can be handled using the Web HMI.

The COM600F integrates substation devices like protection and control relays, substation controllers and meters based on the IEC 61850 communication standard, other legacy and de-facto protocols on the substation network. A seamless connectivity can be established with a gateway functionality between the substation devices and external higher-level systems such as Network Control Center (NCC) or a process such as Distributed Control System (DCS) using DNP3, Modbus or OPC-based protocols.

The COM600F comprises of an application environment that facilitates the development of customized substation automation tasks based on the IEC 61131-3 standard.

The COM600F hardware platform is based on ruggedized mechanics with no moving parts subject to wear and tear. The compact and robust design is well adapted for harsh environments.

A faster project execution is enabled by a preinstalled software and an off-line configuration performed on a separate computer.

Distribution automation controller solutions COM600F is a vital component in medium

voltage substation automation solutions that can comprise of components such as Relion 610, 611, 615, 620, 630 series, RIO600 Remote I/O series and third party relays, based on IEC 61850 and other open protocols. Besides functions and applications realized using single or multiple protection and control relays, advanced/ value added functions or applications can also be realized in the COM600F unit by using the process data from the protection and control relays and its own inherent features. In this manner, more processed information can be made available to higher-level systems such as NCC or DCS, thus creating smarter substations.

An integrated approach using a combination of the Relion® 610, 611, 615, 620, 630 series, RIO600 and COM600F in medium voltage switchgear or dedicated cabinets is categorized under Distribution automation controller solutions. Such solutions are envisioned in industries, infrastructure or electric utility based projects. Some examples are categorized as below:

- With legacy protection and control installations in primary distribution substations
- A mix of brownfield and greenfield installations based on IEC 61850 in primary distribution substations
- In greenfield or brownfield secondary distribution substations
- In combination with Compact Power Management load-shedding solution, (CPMS from ABB), especially for small or medium sized industries or infrastructure installations
- Above solutions could involve running functions or applications in the COM600F involving multiple feeders' data acquired from their respective protection and control relays
- In grid automation applications, looking in an "outward" direction from the substation

Each of the application scenarios mentioned above can involve multiple feeders whose data is acquired from their respective protection and control relays to COM600F.

The COM600F primarily offers the following two applications:

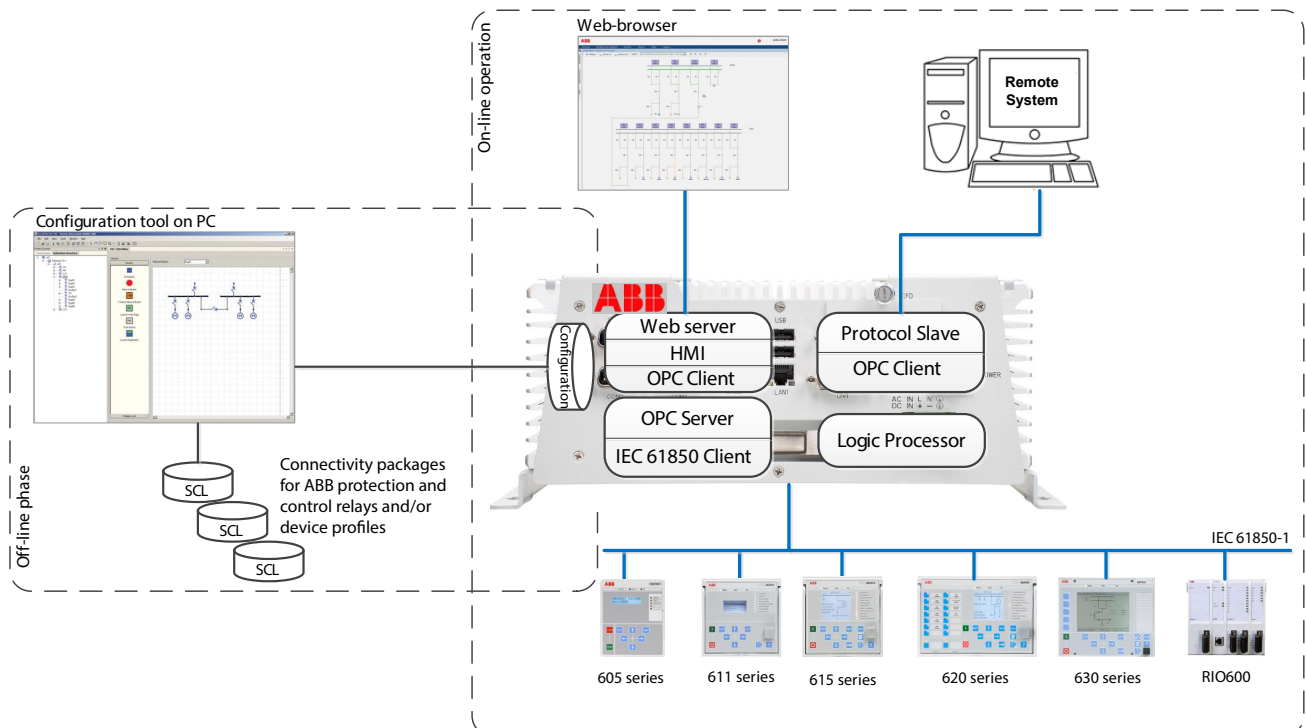
- Distribution automation

COM600F is a distribution automation and data management device that integrates devices, facilitates operations and manages communications in utility or industrial distribution substations

- Substation feeder automation

COM600F is a substation feeder automation and data management device that runs distributed applications in ANSI standard based utility power networks

01 Figure 1. COM600F overview



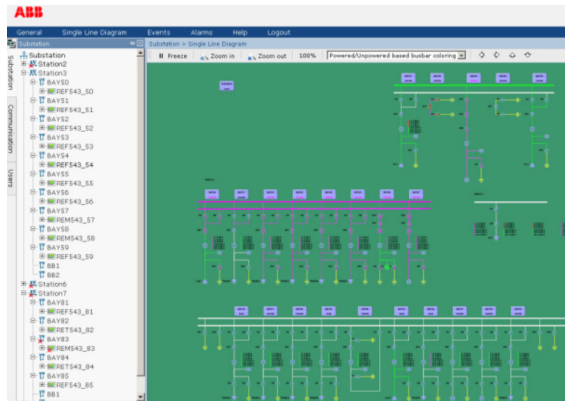
Application

The COM600F has the capability to function as a combined substation HMI, gateway and process controller in a small to medium sized substation automation installation. Its HMI feature enables substation monitoring and operations. It integrates various protection and control relay units based on standard and de-facto protocols and provides access to real-time data. It also records process data in its historian to enable access to past data. Its logic processor enables implementation of substation-level automation tasks. The gateway functionality provides a provision to communicate data from protection and control protection and control relays in the substation and COM600F itself to higher-level systems and vice versa.

The substation installation could comprise of the following components/aspects:

- A medium voltage network in an industrial or utility installation
- 30 to 80 feeders with typically one protection and control protection and control relay associated with every feeder
- Protection and control infrastructure comprising of Relion 630, 620, 615 and 611 series protection and control relays
- Remote IO RIO600 or 3rd party protection and control relays enabled with IEC 61850 communication capabilities
- Protection and control infrastructure comprising of Relion series, legacy protection and control relays, or 3rd party protection and control relays enabled with legacy protocols such as IEC 60870-5-103, DNP 3.0, Modbus
- Other communicable units such as meters, substations or process controllers on any of the standards protocols mentioned above
- Data communication based on Ethernet or RS232/485 physical standards
- Redundantnon-redundant communication infrastructure based on IEC 61850 (IEC 62439 PRP/HSR)
- Installation based on ABB or 3rd party switchgear
- Connectivity to higher level systems: substation automation units such head end SCADA systems, process DCS such as System 800xA, and control center systems such as DMS, etc. using standard protocols such as IEC 60870-5-101/104, DNP 3.0, Modbus, and OPC

Figure 2. Web HMI: SLD view



Process visualization

COM600F includes a web-browser-based user interface (Web HMI). This feature is enabled as default and it is used for efficient substation process visualization, monitoring and control.

The substation single-line diagram (SLD) content is displayed on one screen. The SLD recognizes different voltage levels and busbar systems such as single busbar, double busbar and duplex systems. The four-mode busbar coloring visualizes the busbar status and is user-configurable.

COM600F supports customized SLD views for substation, voltage level and bay objects. It has a substation level view, detailed bay views based on a zoom and panning facility. Three levels of display representations are possible: Master View, Substation View and Bay View with definitions of what is needed to be visible and controllable at each of the mentioned views. The Bay View can be accessed from the Master/Substation Views or from the substation hierarchical structure.

The SLD can be configured to include an indication for the local/remote selection switch. Alarm symbols and generic symbols can be placed in the SLD to give an even better overview of the status.. In addition, generic control buttons can be added to control objects. A separate control dialog is used for controlling the switching device. It provides information on switching device identification, reservation status and interlocking conditions. The select-before-execute logic is used to prevent unintended operation. By reserving the switching device for a single user, the risk of controlling the device from two different locations is eliminated. COM600F supports the multiple-level control of a circuit breaker or a disconnector, as per IEC 61850 Edition 2.

This feature requires Mozilla Firefox®, Opera, Google Chrome or Microsoft Internet Explorer (IE) with Adobe SVG viewer 3.03. If IE 9.0 or later is in use, Adobe SVG viewer is not needed.

Figure 3. Example of distribution automation controller in industrial substation

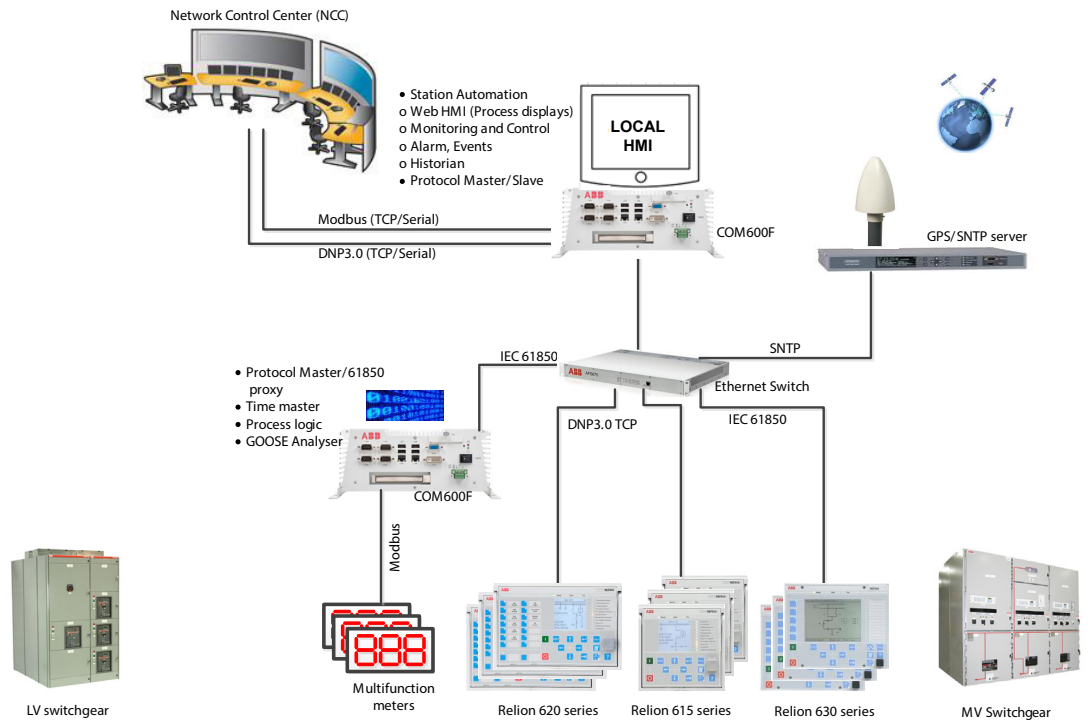


Figure 4. Example of combined distribution automation controller and cPMS for industrial substations

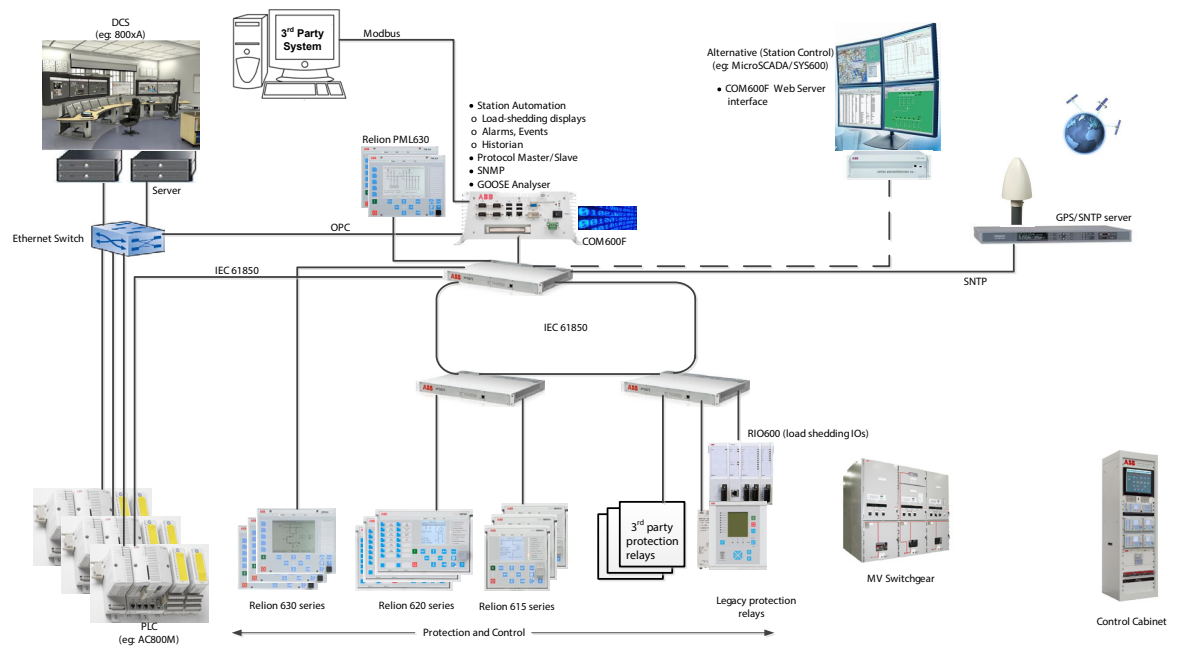
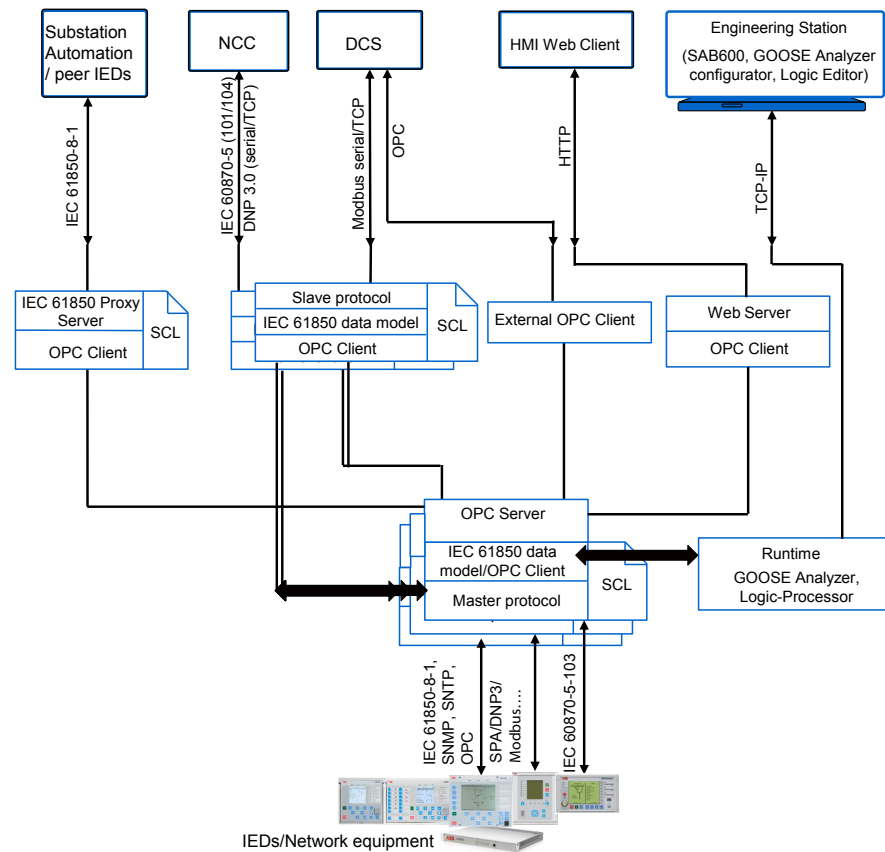


Figure 5. Modular OPC architecture



Modular OPC approach

The product architecture of the COM600F follows a modular approach using OPC.

This architecture facilitates addition of new product features that makes the COM600F versatile.

Ease of handling and improved usability

The improved SCL Import feature for IEC 61850 communication ensures an efficient handling of imported SCL data and COM600F configuration in SAB600.

This improvement is featured especially in the following:

- importing standard or user-defined templates for alarm/event handling
- parameter filtering tool configuration
- protection and control relay SLD configuration
- protection and control relay summary tables

It is also possible to create reports using standard or user-defined templates in the COM600F HMI Client machine that also runs the Vtrin Client. MS Excel (2010 and lower) 32 bit installation is a pre-requisite for the presentation of the reports.

Figure 6. Uplink Address Table

Uplink Address Table

IEDType	OrderCod	prefix	LNClas	InIns	CDC	CDCName	IndicationInde	PositionInde	GeneralInde
Generic	Generic		LLN0		INS	Beh	Not Defined		
Generic	Generic		LLN0		SPS	SetSeld	Not Defined		
Generic	Generic		LLN0		SPS	SetChg	Not Defined		
Generic	Generic		LLN0		INC	ActSG	Not Defined		
Generic	Generic		LLN0		SPS	Loc	Not Defined		
Generic	Generic		LLN0		INS	LocRem	Not Defined		
Generic	Generic		LPHD	1	INS	PhyHealth	Not Defined		
Generic	Generic		LPHD	1	INS	PhyHealth1	Not Defined		
Generic	Generic		LPHD	1	INS	PhyHealth2	Not Defined		
Generic	Generic		LPHD	1	SPS	PwrUp	Not Defined		
Generic	Generic		LPHD	1	SPS	PwrDn	Not Defined		
Generic	Generic		LPHD	1	SPS	PwrDn1	Not Defined		
Generic	Generic		LPHD	1	SPS	OutOv	Not Defined		
Generic	Generic		LPHD	1	SPS	OutOv1	Not Defined		
Generic	Generic		LPHD	1	INC	ChgFlg	Not Defined		
Generic	Generic		LPHD	1	SPC	FacSet	Not Defined		
Generic	Generic	DIAG	LCCH	1	SPS	ChLiv	Not Defined		
Generic	Generic	DIAG	LCCH	1	SPS	RedChLiv	Not Defined		
Generic	Generic	CCB	RBRF	1	ACD	Str			Not Defined
Generic	Generic	CCB	RBRF	1	ACT	OpEx			Not Defined
Generic	Generic	CCB	RBRF	1	ACT	Opln			Not Defined
Generic	Generic	LED	PTRC	1	ACT	Op			Not Defined
Generic	Generic	TRP	PTRC	1	ACT	Op			Not Defined

CID Import

Export

Import

Apply

Cancel

A cross-reference tool is now available for automatically configuring data point addresses, when COM600F is an IEC 60870-5 or DNP3.0 or Modbus slave to a higher-level system. The user can select the necessary data objects from the communication tree structure in SAB600 and create a project-specific template.

Standard or default templates can also be used. The data point addresses are automatically assigned based on Logica Node classes and groups, downstream protection and control relay index (derived from its IP address).

COM600F can be configured and commissioned without a local keyboard and monitor connection. Using the Microsoft® Remote Desktop Protocol (RDP) connectivity, an external computer can be connected to the delivered COM600F on the same network.

The event list entries can be backed up and stored locally in the operational mode of the COM600F local computer. Alternatively, an event list backup can be scheduled as a background process.

The security events and Data Historian entries can also be backed up manually or automatically in the same way.

A summary table provides an overview of the selected online data from a single or multiple protection and control relays. It can be accessed underneath the corresponding protection and control relay object or underneath the substation object. The table can be spread across multiple pages.

Figure 7. Summary table

ABB GAT (station)
5.12.2014, 18:22:58

General Single Line Diagram Events Alarms Data Historian GOOSE Analyzer Help Log out [com600]

Substation GAT > 615_50 > Q02

Measurement Switches status

	PhA	PhB	PhC
CMMXU1	41,70825	59,57581	52,68774
VMMXU1	15,15031	12,02565	16,77307

	High Alarm	High Warning	Low Alarm	Low Warning
CMMXU1	False	False	False	False
VMMXU1	False	False	False	False

	Status
X110_Input1	OFF
X110_Input2	CB_OFF
X110_Input3	OFF
X110_Input4	ON
X110_Input5	CB_Blocked

5.12.2014	18:22:48.026	Q02	Operate	General On	Active	100
5.12.2014	18:22:48.026	Q02	Operate	General On	Inactive	100
5.12.2014	18:22:48.026	Q02	Operate	General On	Inactive	100

Parameter setting

The parameter setting tool (PST) is used for viewing and/or setting parameters in protection and control relays supporting IEC 61850 parameterization. The PST enables the activation of the parameter setting function for the selected protection and control relay. It incorporates a feature that displays only the selected parameters on the COM600F web HMI, thereby limiting the number of visible parameters considered important for substation operation.

Changes in the settings require engineering or administrator rights in COM600F.

Event and alarm lists

Process Alarm and Event list together with audible alarm management is supported. These alarms and events are identified by date, time, bay, device, object description and status. Furthermore, the events and alarms can be automatically filtered according to voltage level or bay criteria. By default, 50 MB of disk space is reserved for storing the events. The storage enables the recording of up to ca. 500,000 events. The amount of disk space reserved for the events can be configured by the user. First-in, first-out logic is used for overwriting events. The user can export an event list to a .csv file for further analysis. COM600F also supports printing of events to an event printer.

Disturbance and fault record handling

COM600F automatically uploads disturbance records from the connected protection and control relays. The disturbance records are saved in the standard COMTRADE format. An in-depth analysis is enabled using the WaveWin ABB software disturbance record analyzer supporting the COMTRADE format. The automatic upload of disturbance records uses the IEC 61850 file transfer services or File Transfer Protocol (FTP). The files can be transferred from the COM600F to an external computer using FTP.

COM600F includes an optional HMI functionality that supports the viewing of fault records from the 611, 615 and 620 series protection and control relays.

The records enable the user to analyze recent power system events.

Each record includes current, voltage and angle values, etc. The fault records are marked with consecutive fault numbers and time stamps that indicate when the faults were detected.

Data Historian

The COM600F Data Historian is a real-time database designed and optimized for process information management and extensive history recording.

The Data Historian is based on ABB's cpmPlus Knowledge Manager software. It combines the benefits of an easy-to-use real-time database with industrial reliability, performance, and real-time functionality to provide an excellent platform for process information management. The Data Historian can be used for accurate process performance monitoring by following process and equipment performance calculations with real-time and history values. Better understanding of the process behavior by joining time-based process measurements with production and maintenance events helps the user to understand the process dynamics. It further provides required information for learning how to keep the process running. High performance and reliability, together with maintenance-free operation, provide a solid platform for trending. The optional Data Historian functionality offers means of storing, analyzing and presenting process data. A data export tool allows retrieval of data in .csv format for analysis in Excel.

Figure 8. Alarm list showing persisting and fleeting alarms

ABB									
cPMS Demo Panel 28-11-14, 13:39:52									
General Single Line Diagram Events Alarms Data Historian GOOSE Analyzer Help Logout									
AA1 Filter Ack Ack All View Events Toggle Alarm Footer									
Substation Communication Users	Persisting Alarms								
	Selected	Date	Time	Bay	Device	Object Text	State	Status	Quality
	<input type="checkbox"/>	28-11-14	13:37:58.020	Q01		SN1 Load shed operated	Active	Active	
	<input type="checkbox"/>	28-11-14	13:37:58.020	Q01		Trip command to P16 OG32	Active	Active	
	<input type="checkbox"/>	28-11-14	13:37:58.020	Q01		Trip command to P08 OG21	Active	Active	
	<input type="checkbox"/>	28-11-14	13:37:58.020	Q01	G21	P02 G21 CB Position	Open	Active	
	<input type="checkbox"/>	28-11-14	13:37:58.015	P02		P02 G21 CB Position	Open	Active	
	<input type="checkbox"/>	28-11-14	13:21:27.094	P15		P15 MF31 CB Position	Closed	Acknowledged	
	<input type="checkbox"/>	28-11-14	13:21:19.457	P04		P04 IT22 CB Position	Closed	Acknowledged	
	Fleeting Alarms								
	Selected	Date	Time	Bay	Device	Object Text	State	Status	Quality
	<input type="checkbox"/>	28-11-14	13:39:26.563	P10	P10_MF25		Device Connection Lost	Inactive	
28-11-14		18:51:30.948	Q01			Slow Load Shed Start	Inactive	Acknowledged	100
28-11-14		18:51:30.948	Q01			Slow Load Shed Operate	Inactive	Acknowledged	100
28-11-14		18:51:30.948	Q01			Sub network1 manual Load shed	Inactive	Acknowledged	100

Figure 9. Disturbance Record information access for ABB protection and control relays

The screenshot displays the ABB COM600 WebHMI application interface. The browser address bar shows the URL `http://localhost:4145/WebHMI/application.aspx`. The application title is "COM600(station) - com600...". The top menu bar includes "File", "Edit", "View", "Favorites", "Tools", and "Help". The main header area shows the ABB logo and the station name "Ristinummi 6/33kV (station)" with a timestamp "10.10.2014, 13:55:41".

The left sidebar contains a navigation tree with categories: "Substation", "Communication", and "Users". Under "Substation", there are sub-items for "Q3", "Q9", "VTR", "ICC7", "MODBUS_7", "Disturbances", "REF543_3", "REF543_3_I3", "Parameters", "Measurements", "REF615", "Parameters", "Fault Records", and "Measurements". Under "Communication", there are "H2" and "H3" sections, each containing "Alarms", "Events", "CTR", "G2", "Q0", "Q1", "Q2", "Q3", "Q3_2", "Q9", "VTR", "REF543_3", "REF543_3_I3", "REF543_62", "SPA2C40x2", "SPA2C LD desc", "LD2 dewsc", and "LD3desc". Under "Users", there are "H2" and "H3" sections, each containing "Alarms".

The main content area is titled "Fault Records" and displays a table with the following columns: "Name", "Value", "Unit", "Min value", and "Max value". The table contains 20 rows of fault records, including "Number", "Time", "MSTA_MaxAmpsA_mag_f", "MSTA_MaxAmpsB_mag_f", "MSTA_MaxAmpsC_mag_f", "MSTA_MaxAmpsN_mag_f", "MSTA_MaxTmpRI_mag_f", "MSTA_AmpsA_mag_f", "MSTA_AmpsB_mag_f", "MSTA_AmpsC_mag_f", "MSTA_VoltsA_mag_f", "MSTA_VoltsB_mag_f", "MSTA_VoltsC_mag_f", "MSTA_VoltsAB_mag_f", "MSTA_VoltsBC_mag_f", "MSTA_VoltsCA_mag_f", "MSTA_AmpsNCic_mag_f", "MSTA_VZroSeq_mag_f", "MSTA_VPsSeq_mag_f", "MSTA_VNgSeq_mag_f", "MSTA_AmpsN_mag_f", "MSTA_AmpsNgSeq_mag_f", "MSTA_DifAngBC_mag_f", "MSTA_DifAngCA_mag_f", and "MSTA_DifAngAB_mag_f".

Name	Value	Unit	Min value	Max value
Number	1		0	999999
Time	10.10.2014 12:09:00.172			
MSTA_MaxAmpsA_mag_f		xIn	0	50
MSTA_MaxAmpsB_mag_f		xIn	0	50
MSTA_MaxAmpsC_mag_f		xIn	0	50
MSTA_MaxAmpsN_mag_f		xIn	0	50
MSTA_MaxTmpRI_mag_f				99,99
MSTA_AmpsA_mag_f		xIn	0	50
MSTA_AmpsB_mag_f		xIn	0	50
MSTA_AmpsC_mag_f		xIn	0	50
MSTA_VoltsA_mag_f		xUn	0	4
MSTA_VoltsB_mag_f		xUn	0	4
MSTA_VoltsC_mag_f		xUn	0	4
MSTA_VoltsAB_mag_f		xUn	0	4
MSTA_VoltsBC_mag_f		xUn	0	4
MSTA_VoltsCA_mag_f		xUn	0	4
MSTA_AmpsNCic_mag_f		xIn	0	50
MSTA_VZroSeq_mag_f		xUn	0	4
MSTA_VPsSeq_mag_f		xUn	0	4
MSTA_VNgSeq_mag_f		xUn	0	4
MSTA_AmpsN_mag_f		xIn	0	50
MSTA_AmpsNgSeq_mag_f		xIn	0	50
MSTA_DifAngBC_mag_f		deg	-180	180
MSTA_DifAngCA_mag_f		deg	-180	180
MSTA_DifAngAB_mag_f		deg	-180	180

Figure 10. Wave-
Win Viewer

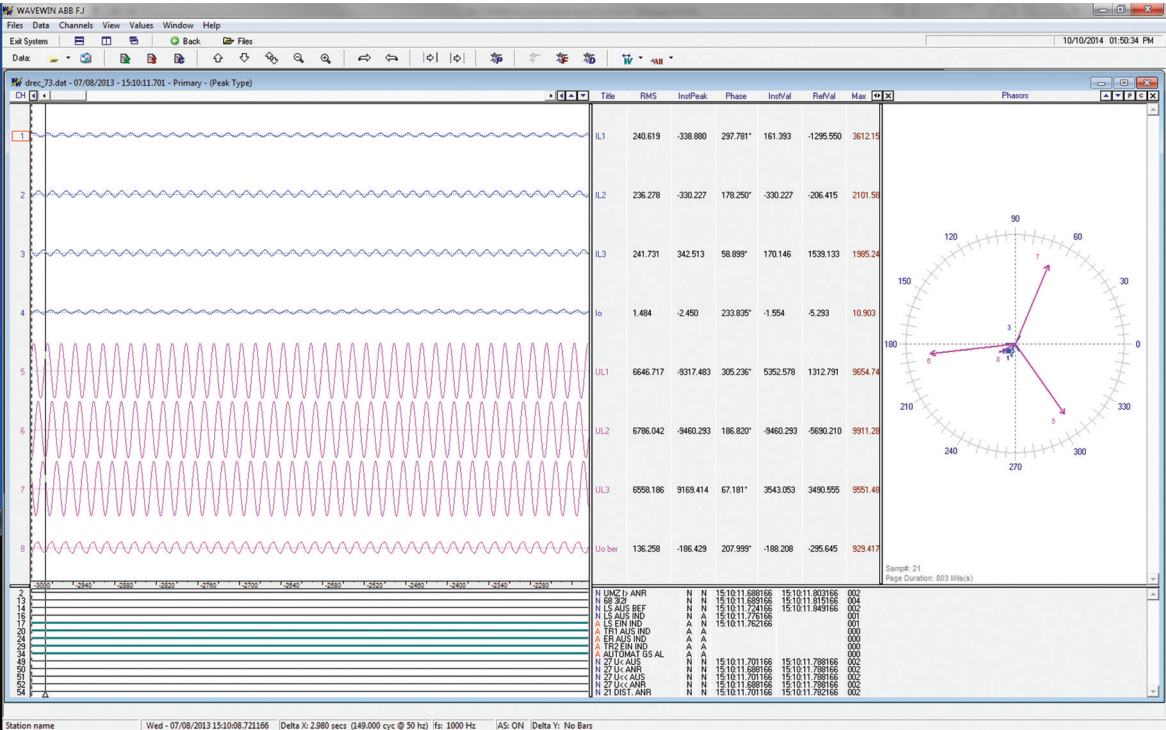


Figure 11. Distribution automation controller with legacy protection and control relays

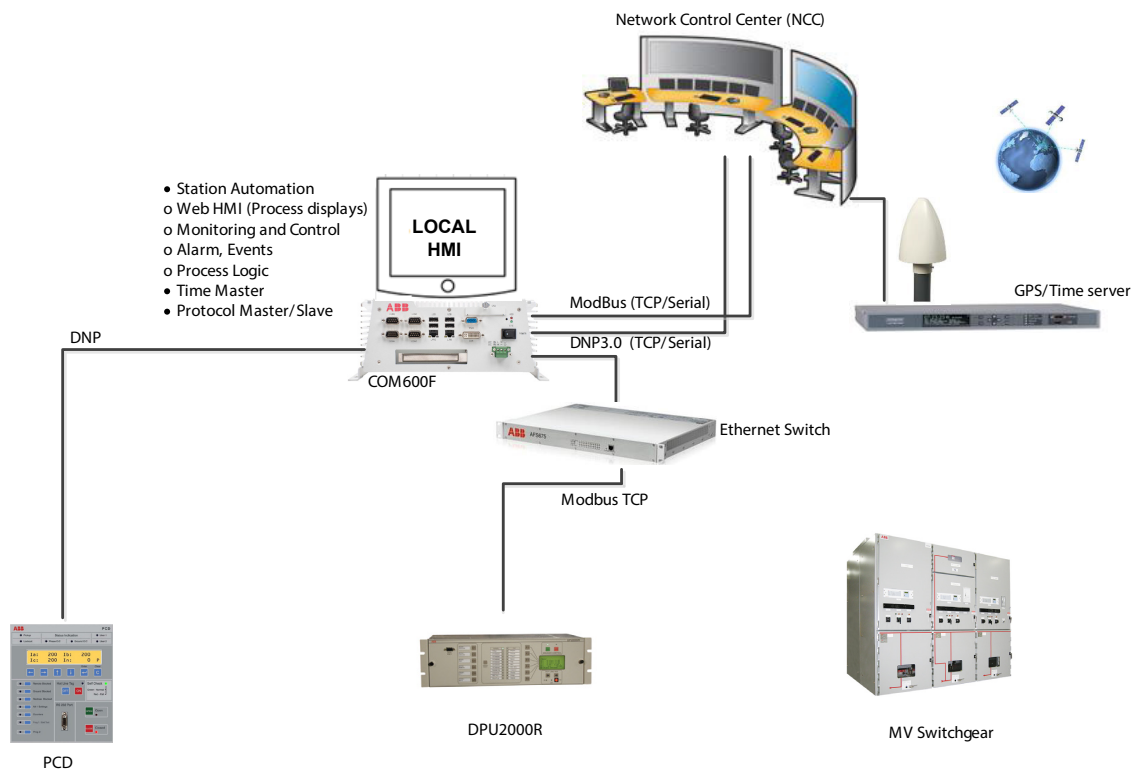
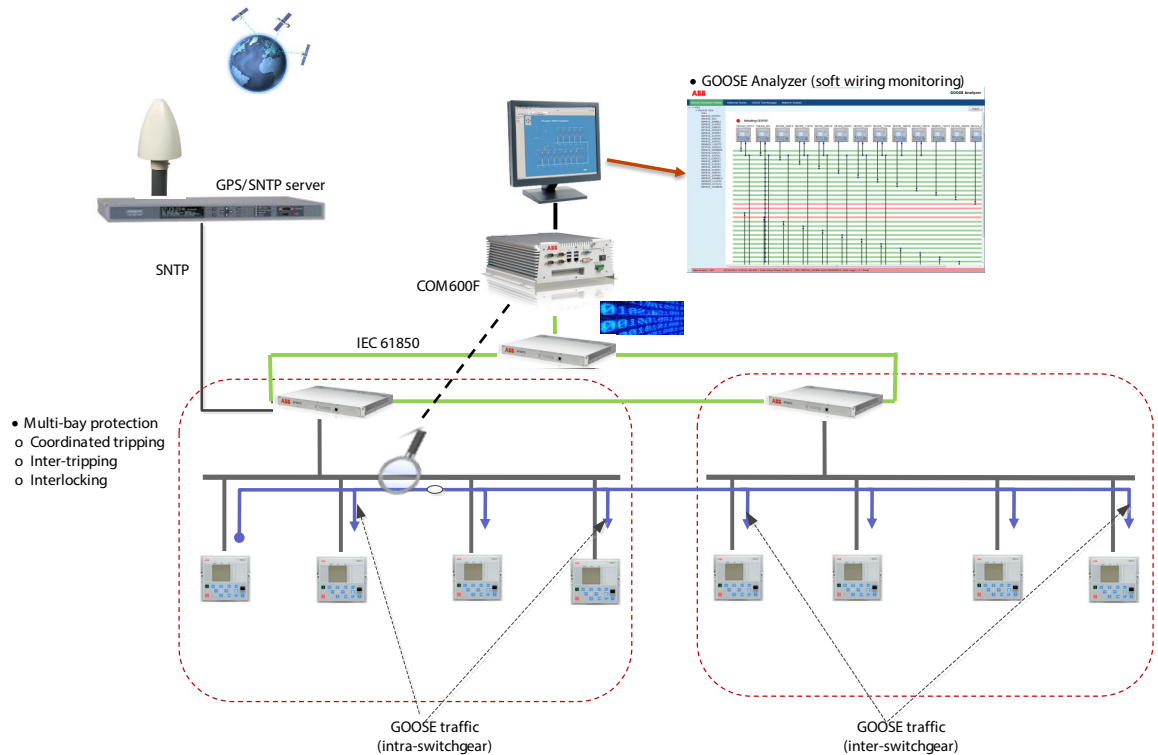


Figure 12. COM600F
GOOSE Analyzer
for monitoring



Monitoring with GOOSE Analyzer

The COM600F GOOSE Analyzer (GA) is a professional system level tool for monitoring and analyzing GOOSE signals exchanged between protection and control relays over IEC 61850-8-1 substation bus. The analysis of GOOSE signals is based on a System Configuration Description file (SCD). This feature can be made use of during commissioning, operation, maintenance and upgrade phases of the system.

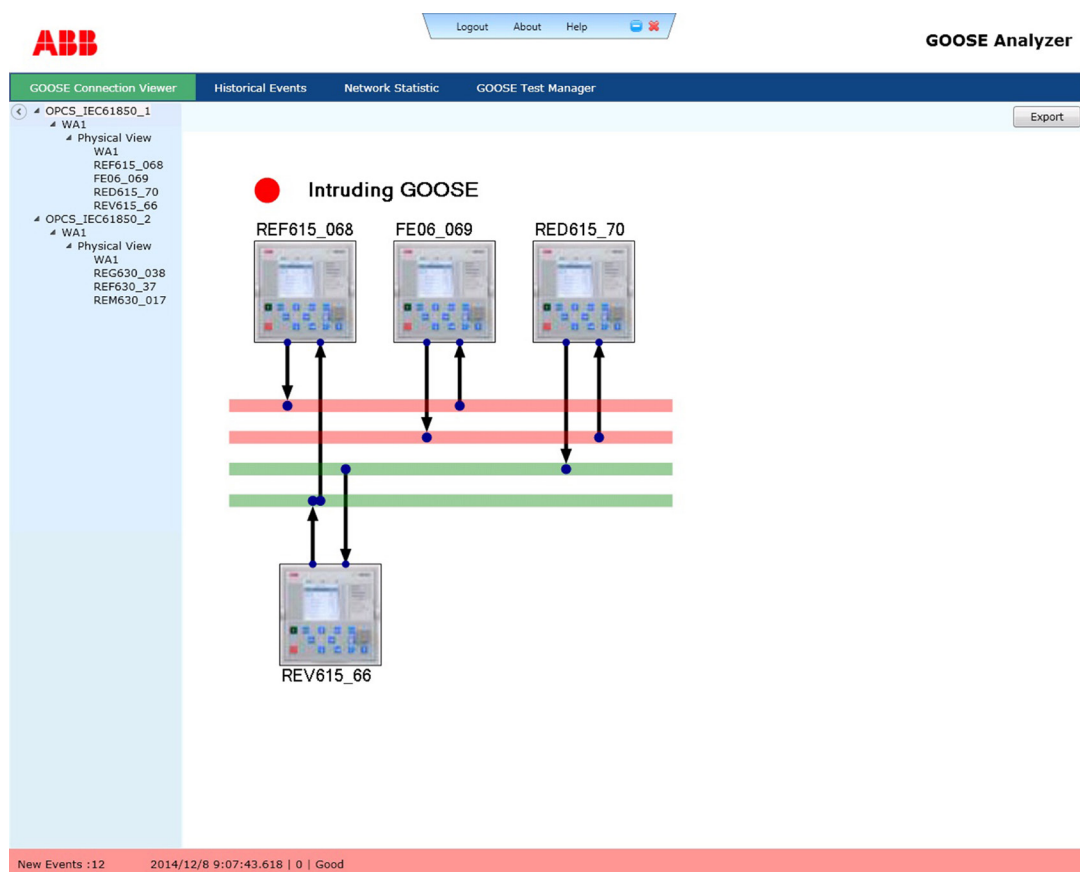
GA consists of a server and a user interface that is integrated with Process Visualization Web HMI. The server incorporates GOOSE Connection Viewer and the GOOSE Test Manager functionality.

The GOOSE Connection Viewer presents graphically the GOOSE signal flow from the publisher to subscriber protection and control relays on a content page. The Connection Viewer enables real-time diagnosis of the GOOSE signal flow presenting the status of communication between devices such as Relion series protection and control relays, Remote I/O RIO600, COM600F itself, other ABB IEC 61850 systems and 3rd party IEC 61850 protection and control relays.

Further, the Viewer provides fast and reliable approach to establish a holistic view of all network devices utilizing GOOSE and the status of the communication links between them. It also provides a continuous list of latest sent values and real-time events. Query of historical events is also supported.

GA displays the diagnostic events on the COM600F Web HMI events list, together with other process events. A dedicated view of the diagnostic is also available under the GOOSE Connection Viewer/ GOOSE Diagnostic Events tab. In this manner, the GA-generated alarms and events can be recorded even when the substation is unmanned or when the GA window is not open.

Figure 13. GOOSE Connection Viewer



Logic Processor

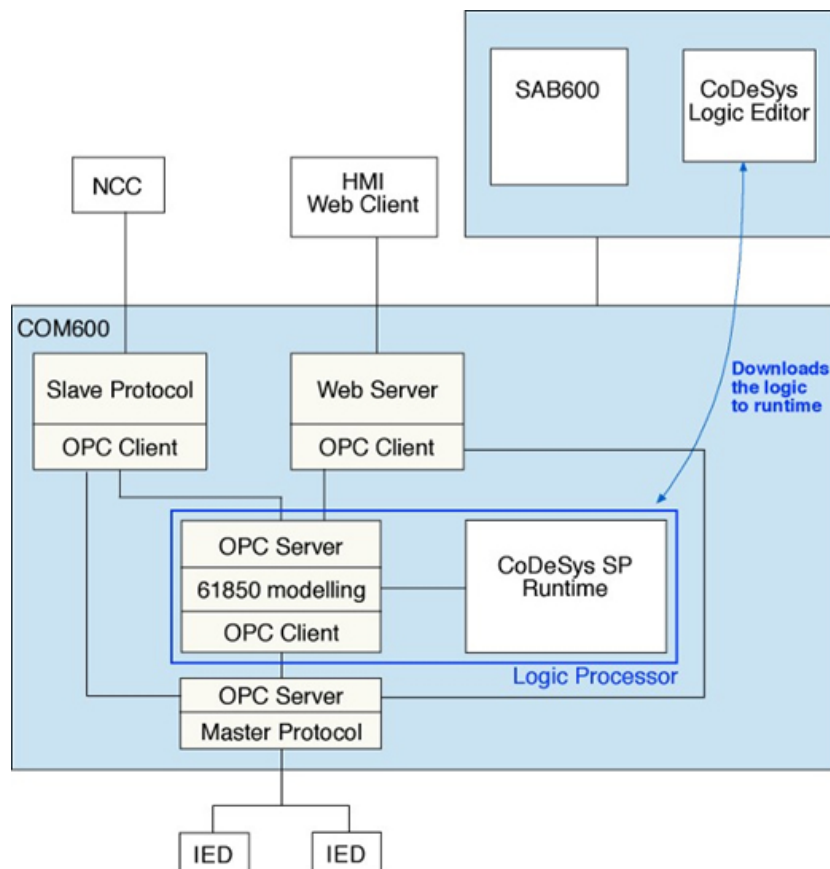
COM600F facilitates the creation and execution of specialized substation automation logic or applications using real time data acquired from connected substation devices, or external systems and activate control actions.

It is also possible to use historical data to execute logic with the help of the Logic Processor feature. This feature supports all five Programmable Logic Controller (PLC) languages specified by IEC 61131-3 standard is offered as an optional feature.

The Logic Processor has on-line and off features for engineering and diagnostics. The results of the application logic can be displayed in the HMI and sent as a command to an protection and control relay or as processed information to an external system, such as an NCC or DCS.

A framework for sequence control application is also available within the Logic Processor. This framework includes HMI functions for controlling and monitoring the sequence execution, and a logic processor library for creating the sequence logic. With the help of sequences the operator can run control sequences to operate multiple switching devices, e.g. circuit breakers, sequentially to a certain state. It is recommended to ensure an optimal usage of the Logic Processor with the overall COM600F runtime performance in mind.

Figure 14. Logic Processor



COM600F Logic Processor Algorithm

The COM600F offers an optional pre-defined algorithm unique to the ANSI market:

- Fault Detection Isolation and Restoration (FDIR)
- FDIR enables the utility to quickly identify the fault location, isolate it, and restore power during an unplanned outage by rerouting the flow of power on the distribution network through unaffected areas.

Benefits include:

- Improved customer service
- Increased revenue
- Lower operations cost
- Reduced risk of fines and lawsuits
- Improve CAIDI and SAIDI metrics by up to 33%
- Decrease restoration time to less than 30 seconds
- Reduce the cost of restoration
- Prevent lost revenues
- Boost the utility's reputation with customers, stockholders and regulators
- Automated logic generation. No PLC programming required

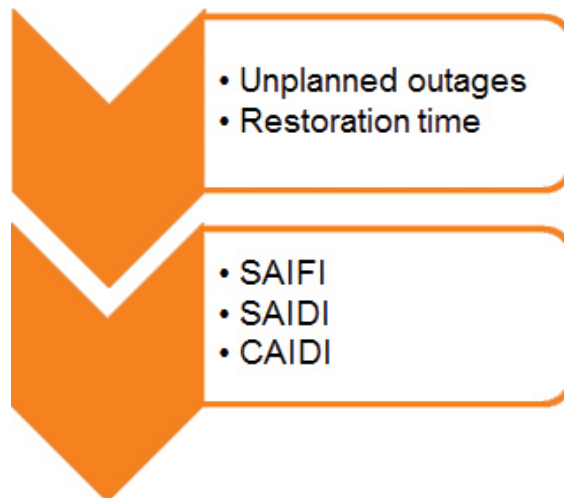


Figure 15. Self healing network

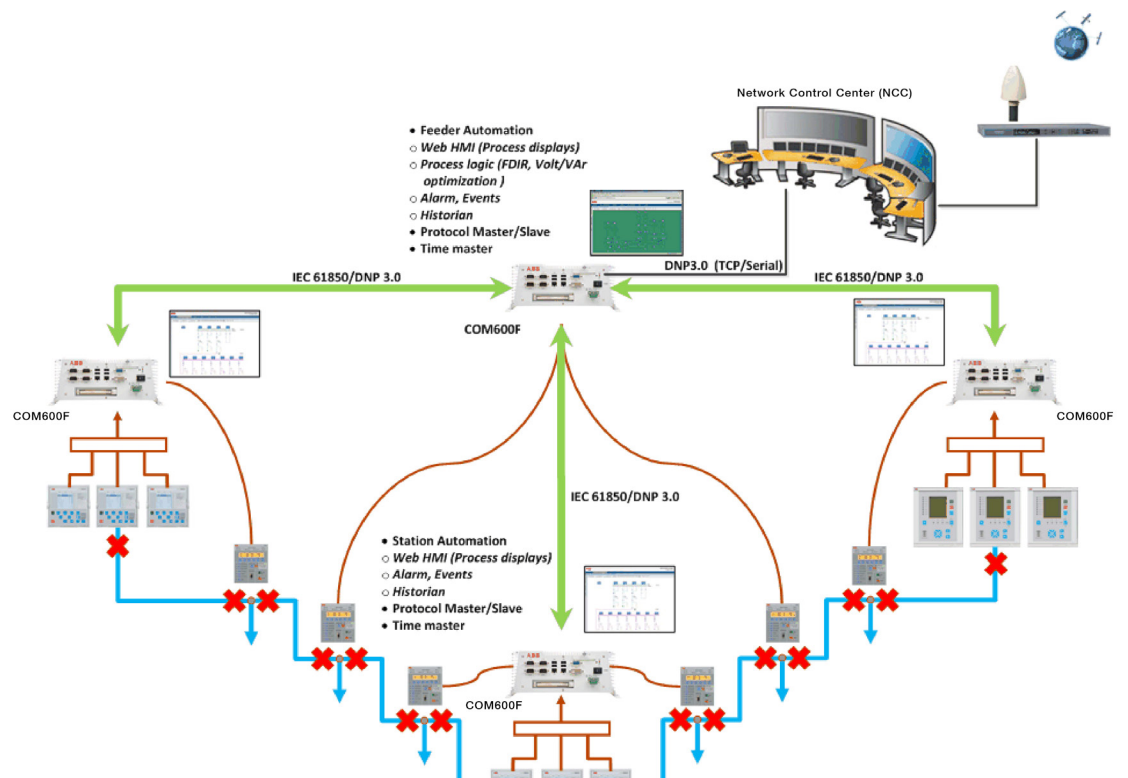
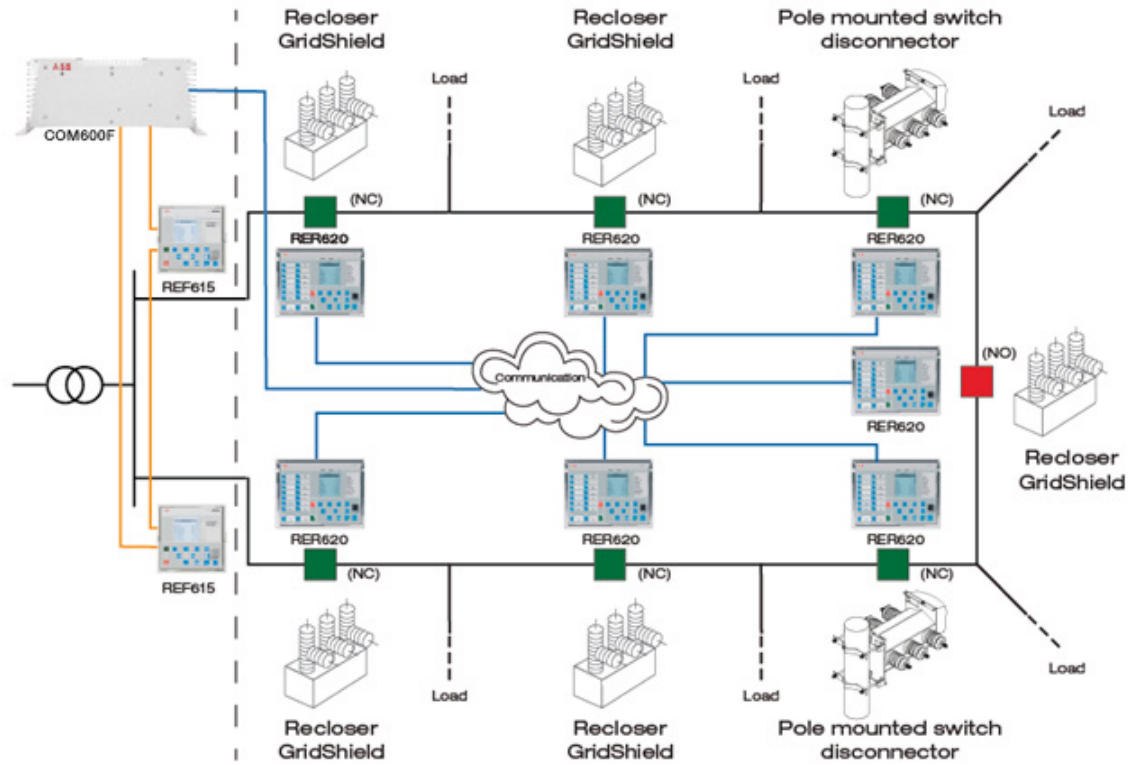
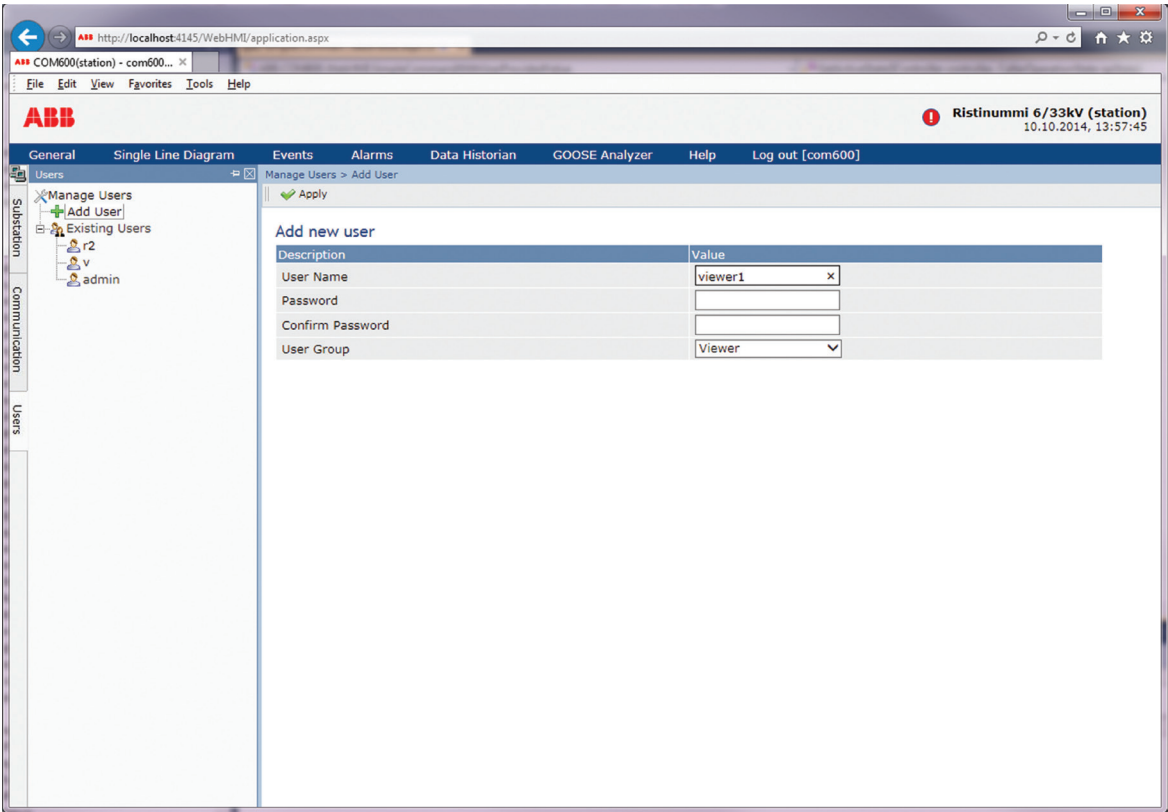


Figure 14. Logic Processor



Access control and substation security

To protect the COM600F from unauthorized access and to maintain information integrity, COM600F is provided with a four level, role-based authentication system with administrator-programmable individual passwords for viewer, operator, engineer and administrator level. Further, the security features include host-based firewalls and communication encryption using the secure HTTPS (HyperText Transfer Protocol Secure) protocol.

Extensive operational security aspects have been included in the COM600F. This includes the following:

- Generating and storing security events caused by user activity and other software operations
- Capturing and storing security alarms/events in protection and control relays connected to COM600F and forwarding them, with the help of the gateway features, to a higher level systems like NCC, DCS or any external subscriber

A dedicated OPC server called Security Event (SEV) OPC server is included to generate security events on a real time basis. The security events in the SEV OPC server are modeled according to IEC 61850. The security alarms and events can be forwarded using IEC 60870-5-101,104, DNP3.0 (serial/TCP) or Modbus (serial/TCP).

The security alarms and events published in Syslog messaging format by the SEV OPC server, are sent to the Centralized Account Logging (CAL) server that performs a centralized log collection, session management and user authentication.

The CAL server presents logged events, Syslog messages etc. also in the process alarm or event lists.

Figure 17. Handling of system security alarms and events

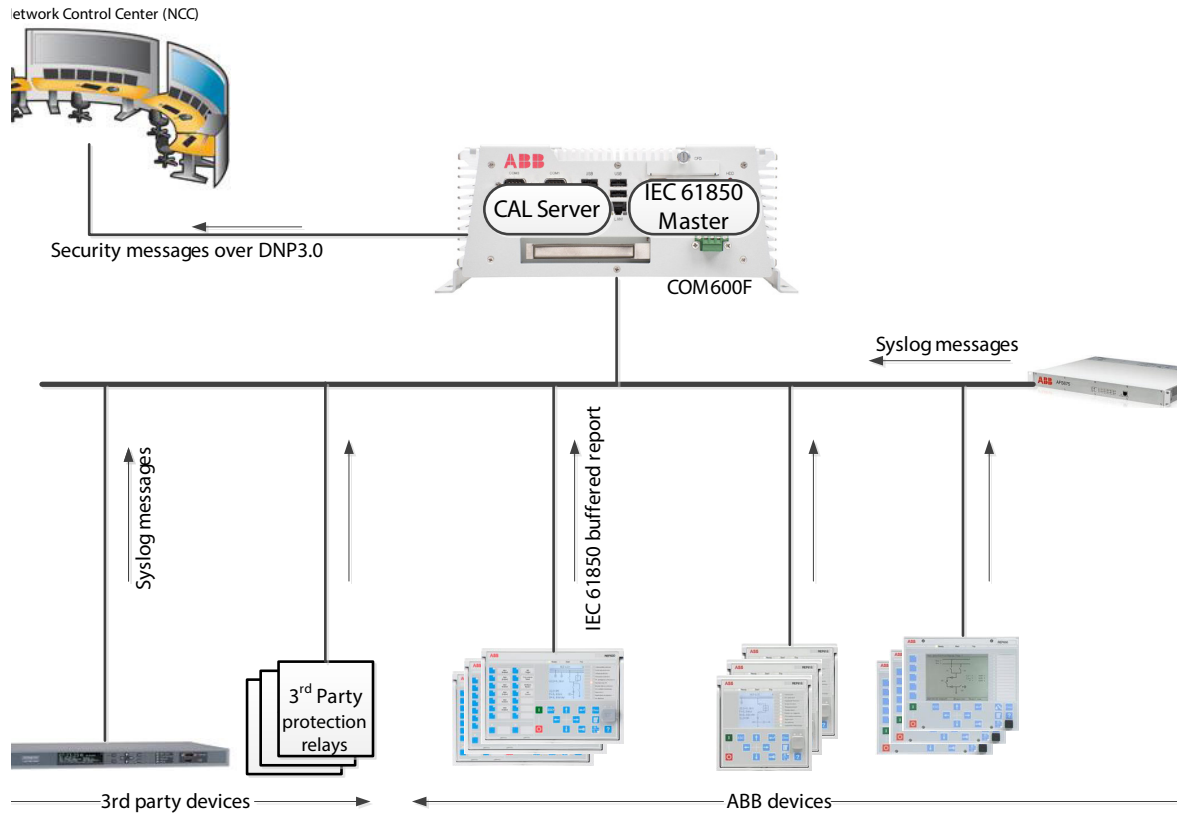


Figure 18. Handling of system security alarms and events

Date	Time	User Name	Event	Source	IP Address	Extra Information
29.4.2014	15:23:53	COM600	Log-in successful [1110]	COM600-PC	127.0.0.1	COM600-PC
29.4.2014	15:23:47	COM600	Log-out (user logged out) [1210]	COM600-PC	127.0.0.1	
29.4.2014	15:23:47	COM600	Date and time set successfully [8020]	COM600-PC	127.0.0.1	2014/4/29-15:23
29.4.2014	15:23:47	COM600	Date and time set successfully [8020]	COM600-PC	127.0.0.1	2014/4/29-15:23
28.4.2014	19:54:13	Anonymous	Connection with configuration tool successful [1310]	COM600-PC	127.0.0.1	

Specific support features for other protection and control relays

The COM600F incorporates a few special process displays and status/control dialogs for:

- Capacitor back protection and control cPMS
- Load-shedding solution using Relion PML630

Figure 19. Status/control dialog: Capacitor bank control

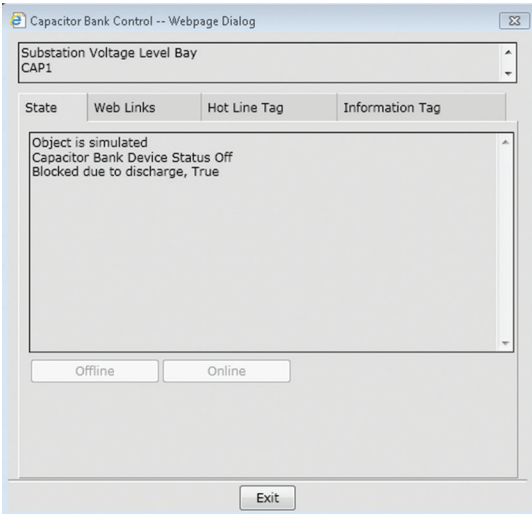


Figure 20. cPMS load-shedding: Subnetwork display

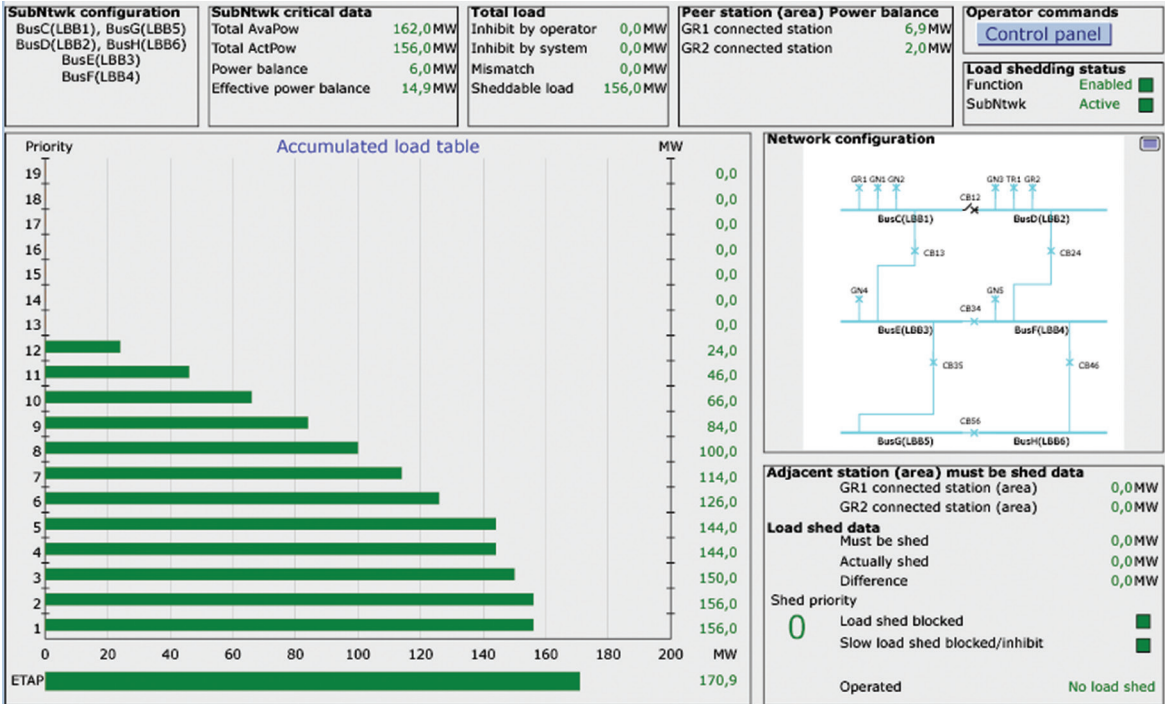


Figure 21. Substation security and secured Web HMI for remote access

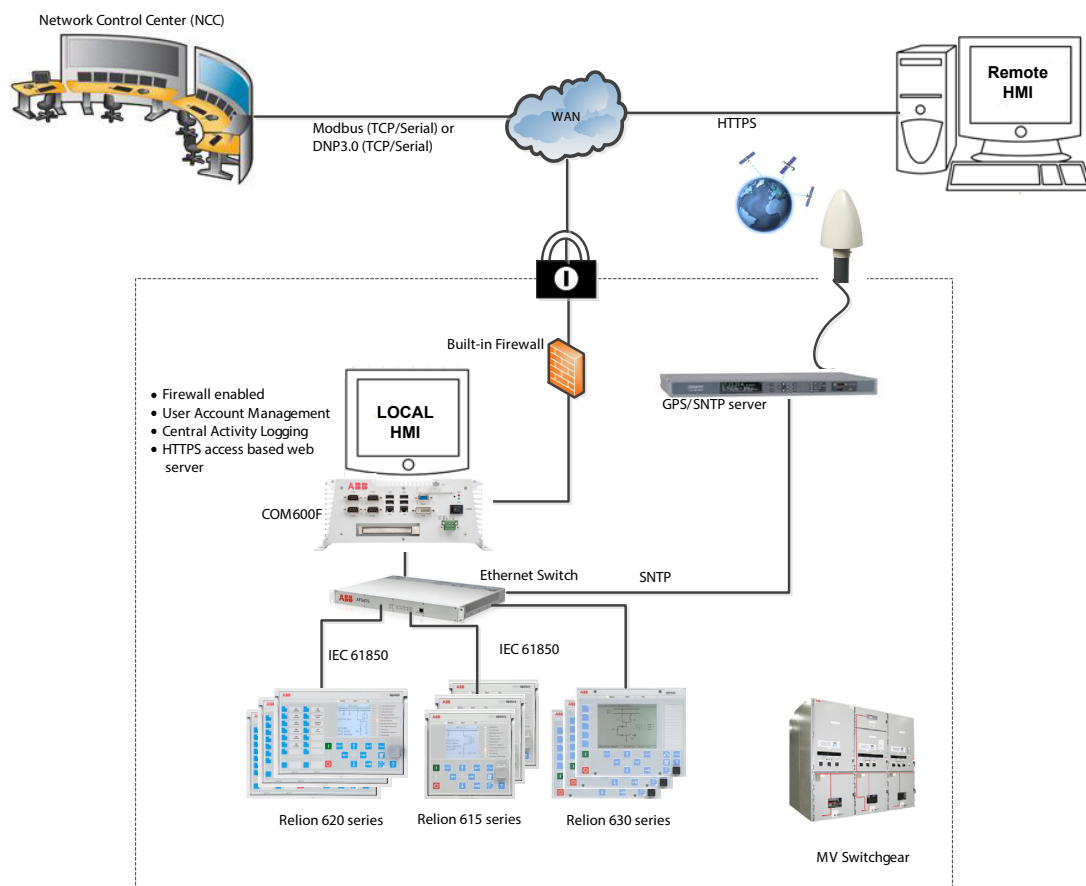
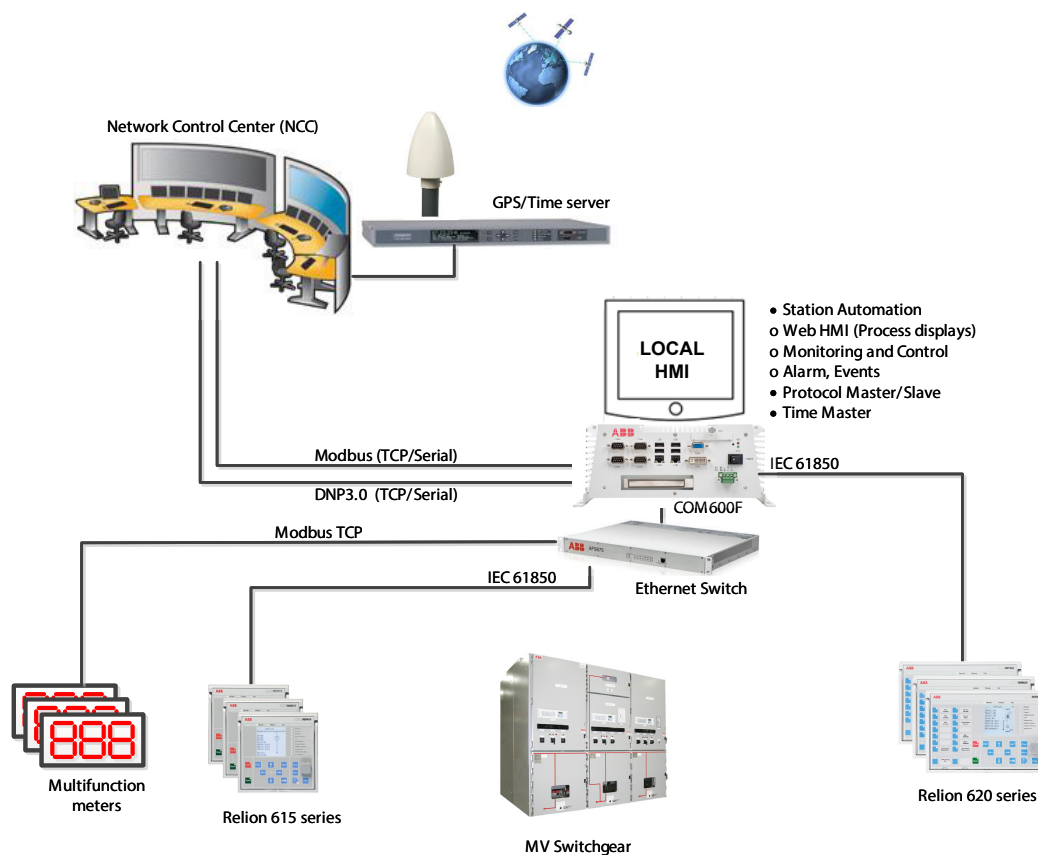


Figure 22. Distribution automation controller for secondary distribution substations

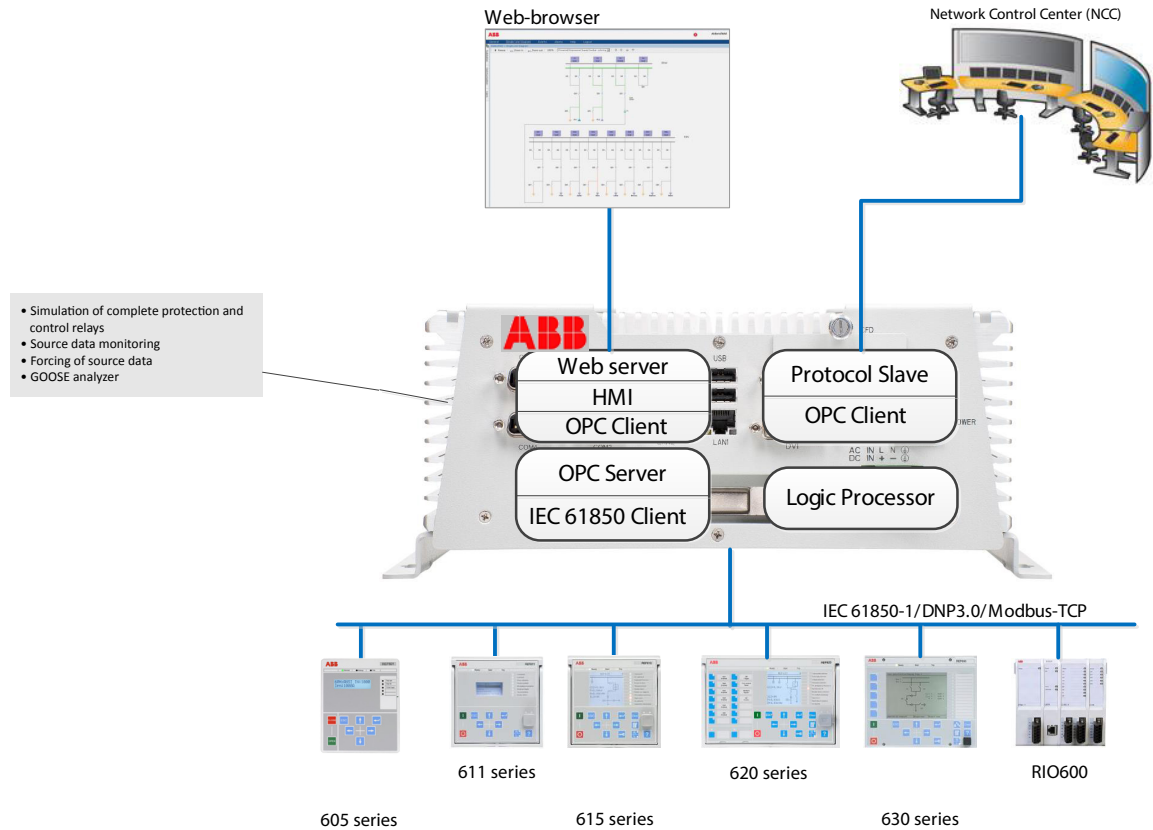


Commissioning and troubleshooting

Besides its GOOSE Analyzer feature, the COM600F also offers several tools and functions to support efficient commissioning and troubleshooting of the substation. The COM600F's built-in protection and control relay simulation functionality enables the testing and verification of the HMI and gateway configuration without any physical connection to protection and control relays and external systems. Further, communication diagnostic events can be enabled to track all messages being sent or received by COM600F.

Using the Station Automation Builder SAB600 (COM600F configuration tool), on-line diagnostic data, real-time process data and communication channels can be analyzed without the need for separate protocol analyzers.

Figure 23. Commissioning and troubleshooting



Communication interfaces

By default, COM600F rackmount is equipped with:

- 2 Ethernet interfaces
- 4 serial interfaces

By default COM600F subplate mount is equipped with:

- 2 Ethernet interfaces
- 2 serial interfaces

As mentioned in section 1, COM600F will be enabled with the IEC 61850 master protocol by default. Hence, the planning of the remaining Ethernet interfaces need to be considered accordingly.

Master and Slave protocols

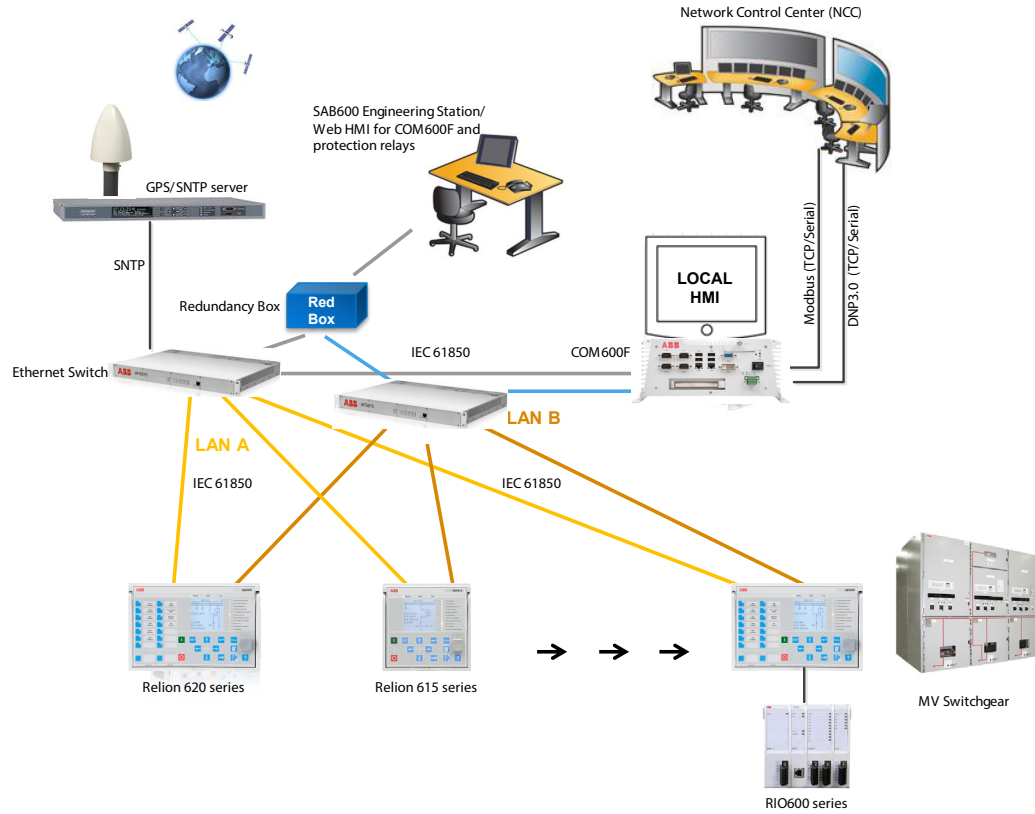
As the COM600F is inherently designed to support the IEC 61850 standard, it can easily and conveniently be integrated an IEC 61850 based substation automation network. The COM600F supports both IEC 61850-8-1 MMS and GOOSE profiles for vertical and horizontal communication with compliant protection and control relays.

Apart from IEC 61850, COM600F also supports other standard, de-facto and legacy master communication protocols like IEC 60870-5-101, 103, 104, DNP3.0 (TCP and serial), OPC, Modbus (TCP and serial) and ABB's legacy SPA (LAN and serial).

This enables the connectivity of both IEC 61850 and non-IEC 61850 based devices (meters, protection and control relays, substation controllers etc.) to the substation automation network. Besides, the COM600F also supports SNTP (Simple Network Time Protocol) for time synchronization and SNMP (Simple Network Management Protocol) for network management.

In order to adapt non-IEC 61850 devices to a IEC 61850 network, the COM600F can also act as a IEC 61850 proxy server converting incoming and outgoing data from/to the external devices. The IEC 61850 proxy server of COM600F is, thereby, very useful during system extensions. The IEC61850 proxy server feature can also be used in cases where the COM600F needs to serve as an IEC61850 data source (protection and control relay).

Figure 24. COM600F in PRP configuration with other Relion series protection and control relays



Note: When IEC 61850 Proxy server is opted for, only one additional slave protocol can be added.

Typical IEC 61850 devices generate vast amount of data. In some cases, it may be necessary to limit the amount of data sent to the SCADA or DCS in order to avoid unnecessary information overflow/handling. The SAB600 cross-reference tool is used to selectively map substation information (from substation devices) or data generated by COM600F itself to slave protocols like IEC 60870-5-101, 104, DNP3.0 (LAN and serial), OPC and Modbus (TCP and serial). Reducing information to higher level systems not only reduces load but also increases operational security. For example, it is possible to disable control actions from a certain higher level system.

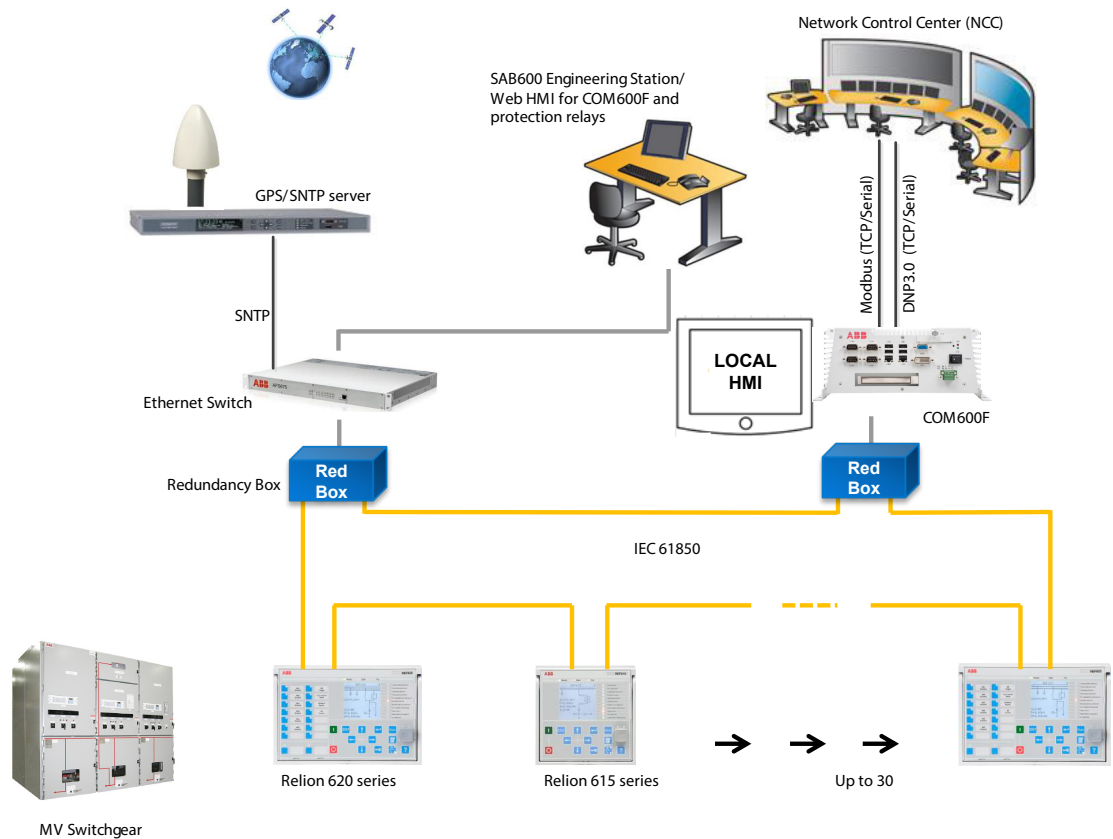
The COM600F OPC client and server connectivity enables data access and data sharing between external systems supporting OPC.

Redundancy

To maintain and improve the reliability of the communication network and the communication between the protection and control relays and COM600F, IEC 62439/PRP (Parallel Redundancy Protocol)-based communication is supported. PRP is based on duplicated networks, where each message is sent via both networks. The first of the received messages is accepted, whereas the duplicate is discarded. Message replication and discarding is done by Duo Driver in COM600F. Further, Duo Driver hides the two networks from upper-level applications. IEC 62439/PRP-based communication requires that COM600F is equipped with an optional LAN card and that the protection and control relays that are used support PRP.

However, COM600F does not support the High-Speed Redundancy ring (HSR) protocol. In order to adapt itself to work in such a communication network, COM600F needs to be connected to an external redundancy box.

Figure 25. COM600F in HSR configuration with other Relion series protection and control relays



IEC 61850 Edition 2 compatibility

The configuration tool of the COM600F, the Station Automation Builder (SAB600) and the realtime data handling part, the IEC 61850 OPC server, can handle SCL files with IEC 61850 Edition 2 rules. These include the following:

- New access point services as defined in IEC 61850-7-2
- Ability to process functions, sub-functions' information for Alarm/Event handling and SLD support
- Support to import instantiated protection and control relay Description and System Exchange Description (SED) files
- Recognizes data from a protection and control relay with multiple access points
- Data object handling for redundant communication
- Longer data semantics
- local remote handling including the multiple level control philosophy
- Parameter revision handling and support in Alarm/Event lists
- New Common Data Classes (CDCs)

Data models may be based on Edition 1 or 2. This enables interoperability of engineering tools and consequently protection and control relays (including COM600F) that are based on either edition.

Note: The SAB600 supports necessary rules for data modeling as per Edition 1, when COM600F is used as a gateway or as an IEC 61850 proxy device for legacy protection and control relays.

Customer value

The COM600F's Web HMI, communication gateway, automation and protection and control relay infrastructure integration features will always be available together.

- Integrated medium voltage switchgear with substation automation
- Easy to add substation automation to existing protection and control installation
- Closer integration with Relion protection and control relays
- Always IEC61850-ready with integrated HMI
- Easy adaptation of legacy protection and control relay infrastructure to IEC 61850, without the need to discard them (through IEC 61850 proxy server). GOOSE communication can therefore be enabled between newer IEC 61850 protection and control relays and older protection and control relays through COM600F
- Monitoring and GOOSE based application monitoring (such as load-shedding etc.) using GOOSE Analyzer feature
- If SCADA or DCS connectivity for substation control fails, a quick "portable" PC can be arranged as HMI
- Centralized automated disturbance record collection, viewing, and transfer
- Digital documentation of all substation drawings and manuals
- Historical data storage could be used to retrieve signal values and represented in trends, reports and also execute substation functionality
- In a packaged solution, customer gets benefits of integrated IEC 61850 substation that brings in combined features of substation HMI, gateway, user access and operational security and station level applications

21. Technical data

Table 1. Dimensions

Description		Value
Subplate mount	Width	12.38 in (314.45 mm with mounting bracket)
	Height	4.68 in (314.45 mm with mounting bracket)
	Depth	9 in (228.6 mm)
Rackmount	Width	19 in (482.6 mm)
	Height	5.22 in (132.6 mm)
	Depth	14.9 in (360.4 mm)

Table 2. Power supply

Description	High voltage supply	Low voltage supply
Input voltage	110-250 V AC 50/60Hz, 125-250 V DC ¹⁾	19 -72 V DC
Power consumption	~45W @ max CPU Load ²⁾	

1) The preferred operating range is 80%-110% of the rated voltage (80% of minimum value and 110% of maximum value).

2) Without optional cards.

Table 3. Hardware

Description	Value
Processor	Intel Core i5-4590T Haswell Quad-Core 2.0GHz LGA 1150
System memory	8 GB DDR3 204-Pin SO-DIMM
Hard drive	128 GB Solid State Drive
Real time clock battery	Lithium battery

Table 4. Interfaces

Description	Value
Serial interfaces	3x RS-232; 2x RS-232/422/485 configurable
Ethernet interfaces	2x GbE RJ-45
Display interfaces	1x VGA; 1x DVI-D; 1x display port
USB	1x USB 2.0; 1x USB 3.0
Audio	1x Line-out; 1x MIC-in

Table 5. Optional PCI extensions

Description	Value
Serial interfaces ¹⁾	8 x RS-232/485 configurable
Ethernet interfaces ²⁾	2 x GbE RJ-45
Fiber Optic interfaces ³⁾	1 x 100FX LC

1) Operating temperature 0° C - +55° C; Storage temperature = -20°C to 85°C; Relative Humidity = 5 to 95% (non-condensing)

2) Operating temperature 0° C - +55° C; Storage temperature = -40°C to 70°C; Relative Humidity = 90% (non-condensing) at 35°C

3) Operating temperature 0° C - +50° C; Storage temperature = -25°C to 70°C; Relative Humidity = 5 to 95% (non-condensing)

Table 6. Operating System

Description	Value
Operating system	Windows Embedded Standard 8

Table 7. Inspection of mechanical structure

Description	Reference
Markings and mechanical structure	IEC 61850-3:2013 6.1
Degree of protection by enclosure	IEC 61850-3:2013 6.11, IEC 60529
Clearance and creepage distances	IEC 61850-3:2013 6.6.1, IEC 60255-27

Table 8. Power supply and module tests

Description	Reference
Subplate mount auxiliary voltage	According to IEC 60255-1
Rackmount auxiliary voltage	According to IEC 60255-1 and ANSI/IEEE C37.90-2005
Aux. voltage interruption	According to IEC 60255-11
Ripple in auxiliary DC voltage	According to IEC 60255-11 15%, $f = 2 \times f_n$
Power consumption	According to CE EN 61010

Table 9. Electromagnetic compatibility tests

Description	Reference
Electrostatic discharge test: • Contact discharge • Air discharge	According to IEC 60601-1-2, IEC 61850-3:2013 +/- Volts = 6 kV +/- Volts = 8 kV
Radiated electromagnetic field immunity	According to IEC 61000-4-3:2010, IEC 61850-3:2013 Severity = 10V/m Start frequency = 80 MHz Stop frequency = 3,000 MHz Modulation = 1 kHz, 80%
Electrical fast transient/burst immunity • Power supply • RJ-45 port • Serial port	According to IEC 61000-4-4:2012, IEC 61850-3:2013 Amplitude = 2 kV Amplitude = 1 kV Amplitude = 1 kV
Surge immunity • Power supply • RJ-45 port • Serial port	According to IEC 61000-4-5:2005, IEC 61850-3:2013 Test level = 2 kV line to ground, 1 kV line to line Test level = 1 kV line to ground, 0.5 kV line to line Test level = 1 kV line to ground
Conducted radio frequency immunity	According to IEC 61000-4-6:2008, IEC 61850-3:2013 Test level = 3 Vrms Frequency range = 0.15 MHz to 80 MHz
Damped oscillatory waves • Transverse • Common	According to IEC 61000-4-18:2009, IEC 61850-3:2013 Test voltage = 0.5 kV Test voltage = 1 kV
Voltage dips, interruptions an variations	According to IEC 61000-4-11:2004, IEC 61850-3:2013 30% for 0.1s 60% for 0.1s 100% for 0.05s
Conducted emissions	According to CISPR 22:2010, IEC 61850-3:2013 Class A
Radiated emissions	According to CISPR 22:2010, IEC 61850-3:2013 Class A

Table 10. Environmental conditions

Description	Value
Operating temperature range	-10°C to 55°C ¹⁾
Relative humidity range, non-condensing	5 to 95% ¹⁾
Storage temperature	-40°C to 85°C ¹⁾

1) Without any option cards. See table 5 for more information.

Table 11. Environmental tests

Description	Reference
Dry heat test - operational	According to IEC 60068-2-2:2007, IEC 61850-3:2013 16h at 55°C
Cold test - operational	According to IEC 60068-2-1:2007, IEC 61850-3:2013 16h at -10°C
Dry heat test - storage	According to IEC 60068-2-2:2007, IEC 61850-3:2013 16h at 85°C
Cold test - storage	According to IEC 60068-2-1:2007, IEC 61850-3:2013 16h at -40°C
Temperature change test	According to IEC 60068-2-2:2007, IEC 60068-2-1:2007, IEC 60068-2-14:2009 IEC 61850-3:2013 5 Cycles, 3h dwells at upper (55°C) and lower (-10°C) temperatures, 1 C/min ramp rate
Damp heat steady state test	According to IEC 60068-2-78:2001, IEC 61850-3:2013 10d at 40°C, 93% relative humidity
Damp heat cyclic test	According to IEC 60068-2-30:2005, IEC 60068-2-78:2001, IEC 61850-3:2013 6 Cycles (12 h + 12 h) Upper limit = 40°C, 93% relative humidity Lower limit = 25°C, 96% relative humidity

Table 12. Mechanical tests

Description	Reference
Vibration tests: • Vibration response test • Vibration endurance test	According to IEC 60255-21-1, IEC 61850-3:2013 Class 1 Class 1
Shock and bump tests: • Shock response test • Shock withstand test • Bump test	According to IEC 60255-21-2, IEC 61850-3:2013 Class 1 Class 1 Class 1
Seismic test: • Single axis sine sweep (method A)	According to IEC 60255-21-3 test method B Class 1

Table 13. EMC compliance

Description	Reference
Complies with 61850-3:2013	61850-3:2013 – Communication networks and systems for power utility automation – Part 3: General requirements

Table 14. Product safety

Description	Reference
Complies with 61850-3:2013	61850-3:2013 – Communication networks and systems for power utility automation – Part 3: General requirements

Table 15. RoHS compliance

Description	Reference
Complies with the RoHS directive	2011/65/EU

—
Table 16. Communication protocols

Master protocol	Slave protocol
DNP3 LAN/WAN	DNP3 LAN/WAN
DNP3 serial	DNP3 serial
IEC 60870-5-101	IEC 60870-5-101
IEC 60870-5-103	
IEC 60870-5-104	IEC 60870-5-104
IEC 61850-8-1 (MMS & GOOSE)	IEC 61850-8-1 (MMS & GOOSE)
Modbus Serial	Modbus Serial
Modbus TCP	Modbus TCP
SNMP (Simple Network Management Protocol)	
SNTP (Simple Network Time Protocol)	SNTP

Common aspects

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Table 17 Hardware requirements for SAB600

Hardware	Minimum	Recommended
Free hard disk space	5 GB	10 GB

—
Table 18. Supported operating systems for SAB600¹⁾

Description
Microsoft Windows Server 2008 R2 (64-bit)
Microsoft Windows Server 2012 R2 (64-bit)
Microsoft Windows Vista (32-bit) SP2
Microsoft Windows 7 (32-bit/64-bit) SP1
Microsoft Windows 8 (32-bit/64-bit)
Microsoft Windows 8.1 (32-bit/64-bit)
Windows 10 (32-bit/64-bit)

1) Microsoft® .NET Framework 4.6.1 is required for running SAB600. The software is automatically installed during the installation of SAB600 if not already available on the PC.

—
Table 19. Supported web browsers for HMI

Description	Version
Microsoft Internet Explorer	10.0 or later
Google Chrome	54.0
Mozilla Firefox®	45.0 or later

Tools

The engineering of COM600F is done offline on a separate computer using the Microsoft® .NET-based SAB600 engineering tool supplied with COM600F. The configurability and functionality of COM600F depends on the communication protocol used for communication between COM600F and the protection and control relays. The connectivity packages for ABB's protection and control relays enable an efficient configuration of COM600F. The connectivity packages include descriptions of the data and signals available in the protection and control relays. The descriptions are used to automatically configure the master communication of COM600F.

At project engineering, SAB600 uses the potential of the IEC 61850 standard by supporting the IEC 61850-based SCL (Substation Configuration Description Language) file import, including the import of the communication and graphical parts of the SCL file. The finalized projects are updated from SAB600 to COM600F at site or remotely provided that a secure Ethernet connection is available.

—
Table 22. Tools

Description	Version
Station Automation Builder SAB600	5.0

Mounting

The COM600F computer is designed for mounting both into a 19 inch control panel or in the low voltage compartment of a switchgear panel by using the included wall-mount kit.

Figure 26. COM600F rack mount dimensions

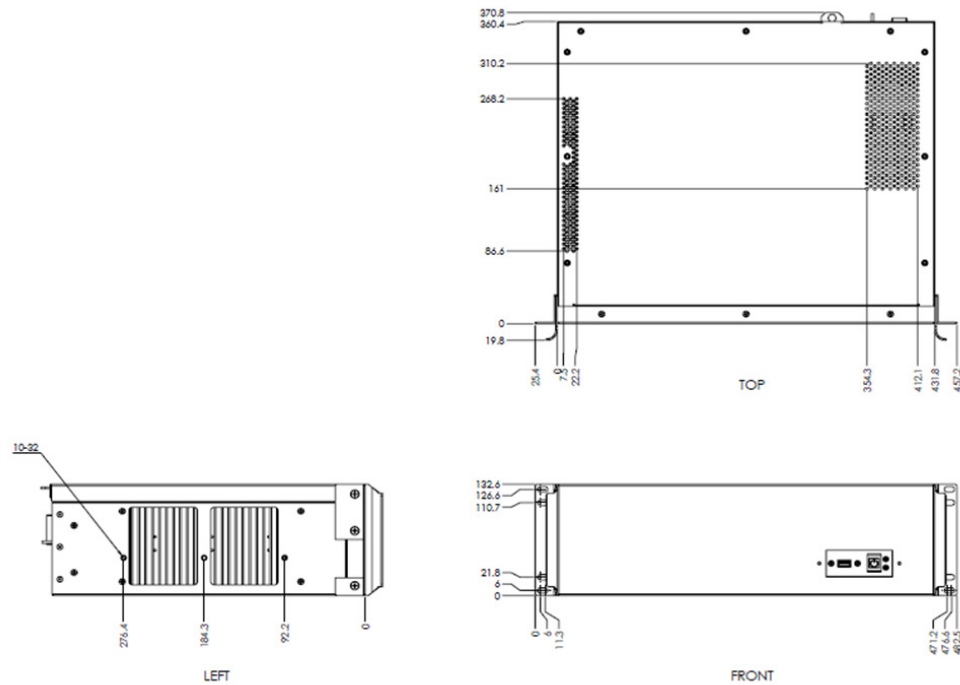
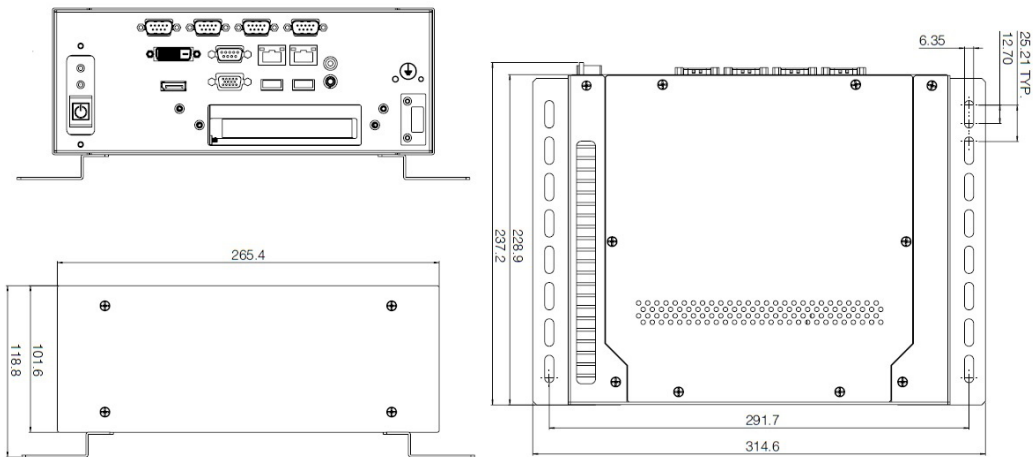


Figure 27. COM600F sub plate dimensions



Selection and ordering COM600F order code

		DIGIT	1-6	7	8	9	10	11	12	13	14	15	16	17	18
Digit	Key	Description	COM600	F	H	N	F	2	1	P	P	A	R	N	F
7) Product	F	COM600F		F											
		Based on Windows 8 embedded inherent with - Intel Core I5, quad core - 8 GB system memory, 128 GB solid state hard drive - Device monitoring software, internal alarming unit													
8) Power supply															
	H	100 - 375 V DC, 88 - 264 V AC			H										
	L	19 - 72 V DC													
9) Optional communication cards (PCI)						N									
	R	Ethernet card (RJ-45) GbE-TX, 2 ports													
	S	Serial RS-232/422/485 card, 8 ports													
	F	Ethernet card (LC) 100Base-FX, 1 port													
	N	None													
10) Application category							F								
	H	Substation control and communication gateway													
	F	Substation control and communication gateway including FDIR (Fault Detection, Isolation, Restoration)													
11) Number of master protocols								2							
	1	One master protocol													
	2	Two master protocols													
	3	Three master protocols													
12) Number of slave protocols									1						
	1	One slave protocol													
	2	Two slave protocols													
	N	None													
13) Optional software (advanced features)										P					
	T	Data historian													
	L	IEC 61131-3 Logic processor													
	P	Data historian and IEC 61131-3 Logic processor													
	N	None													
14) Optional IEC 61850 functionality											P				
	P	IEC 61850 proxy server and GOOSE send enabled													
	G	GOOSE Analyzer enabled													
	A	IEC 61850 proxy server and GOOSE send enabled + GOOSE Analyzer enabled													
	N	None													
15) Device integration												A			
	A	System configuration mainly comprising of ABB relays													
	B	System configuration mainly comprising of non-ABB relays/devices													
	C	Product only (Certified Integrators)													
16) Mounting type															
	A	Subplate mounting (switchgear or panel)											R		
	R	Rack Mount 19 inch													
17) Future														N	
	N	Not used													
18) Version															F
	F	Version 5.0													

Digit 10 - When digit 10 = F (Substation control and communication gateway including FDIR), the digit 13 must be 'L' or 'P'

Digit 14 - "61850 Proxy server occupies 1 slave protocol slot. When digit 12 = 1, then only 1 slave can be configured, If digit 14 = 'P' and 'A', then no additional slave is available. When digit 12 = 2, then 2 slaves can be configured. If digit 14 = 'P' and 'A', then one additional slave is available. If digit 14 = G or N, then either 1 or 2 (non-61850) slave protocols can be configured, according to digit 12 = 1 or 2 respectively."

Digit 9 - a) IEC 61850 PRP based communication redundancy cannot be supported with fiber optic extension card.



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