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SE-330 SERIES (NEW REVISION) IEC 61850 INTERFACE

Revision 0-C-121117
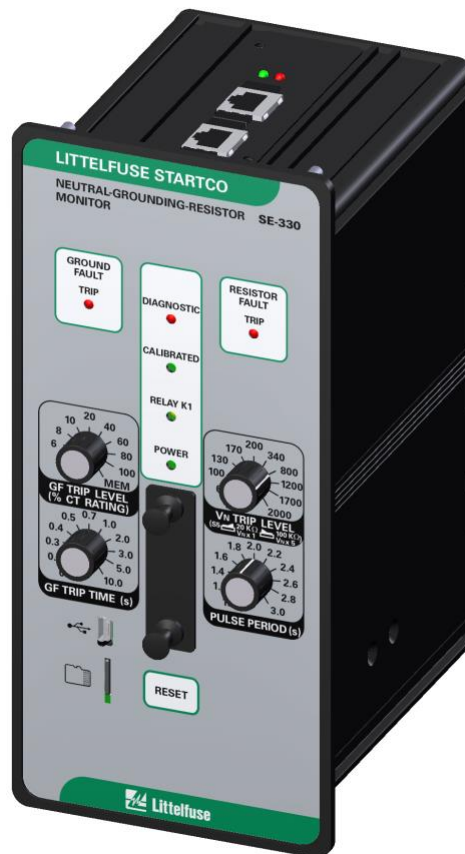
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1. GENERAL

This manual describes the features of the SE-330, SE-330AU, and SE-330HV IEC 61850 interface. Unless otherwise indicated, "SE-330" refers to all three monitor series in general. The optional IEC 61850 interface includes Manufacturing Message Specification (MMS) and Generic Object Oriented Substation Events (GOOSE) elements. MMS Buffered and Unbuffered Report Control Blocks are supported with user-definable Data Sets. Two GOOSE Control Blocks and 16 GOOSE Network Inputs are available to provide high speed peer-to-peer signaling. Three hardware configuration options are available to provide redundant network connections: Dual RJ45, Dual Fiber SC, and Single RJ45/Single Fiber SC.

The IEC 61850 interface is configured using the SE-MON330 configuration software (version 3.2 or later). Modbus/TCP is included to support configuration of the SE-330 over the network. For more information on the Modbus/TCP interface, refer to the SE-330 Series Modbus/TCP manual.

1.1 CONFIGURATION SOFTWARE

The IP, SNTP and IEC 61850 settings are configured using SE-MON330 through the front-panel USB interface. To download SE-MON330, please visit www.littelfuse.com/se-330. For information on how to connect SE-MON330 to the SE-330, please refer to the SE-MON330 help file found in the Help – Contents menu.

2. NETWORK CONFIGURATION

IP and SNTP settings are configured on the SE-MON330 Details Page tab as shown in Fig 1.

2.1 ETHERNET PORTS

Two Ethernet interface types are available for the SE-330:
- 10/100 BASE-Tx full/half duplex Auto-MDIX RJ45
- 100 Mbps fiber SC

Three combinations of these interface types are available:
- Dual RJ45
- Dual Fiber SC
- Single RJ45 / Single Fiber SC

See Figs. 2, 3, and 4.

2.2 IP SETTINGS

When connected to the SE-330 with SE-MON330, the IP settings can be found in the Details Page tab in the Network Parameter section. The IP address, subnet mask and gateway can be configured for each network interface. Default values for these settings are listed in Table 1.

TABLE 1. DEFAULT IP SETTINGS

INTERFACE 1	
IP Address	192.168.1.100
Subnet Mask	255.255.255.0
Gateway	0.0.0.0
INTERFACE 2	
IP Address	192.168.2.100
Subnet Mask	255.255.255.0
Gateway	0.0.0.0

For troubleshooting network connections, the SE-330 supports ICMP ping requests.

Note: Ensure that each port is configured with a unique IP address even if not used.

2.3 SNTP SETTINGS

When connected to the SE-330 with SE-MON330, the SNTP Settings can be found in the Details Page tab in the SNTP Parameter section. SNTP Enable, NTP Server IP Address, Poll Period, and Timeout can be configured.

Enable the SNTP Client and set the NTP Server IP Address to the address of the system NTP Server to synchronize the SE-330 to the system time. For troubleshooting connection problems with the NTP Server, monitor the SNTP Client status. The status indicates problems such as NTP Server not found, NTP Server not running, and timeout.

The Poll Period is the time between queries to the NTP server. The default value is 60 s, which is typically sufficient to maintain time synchronization to 1 ms accuracy, but it can be configured for periods as low as 1 s.

The Timeout is the maximum time that the SNTP Client will wait for a response from the NTP Server. The default value is 5 s, and the minimum time is 1 s. If a request fails, no change is made to the SE-330 internal clock.

2.4 IEC 61850 CLIENTS

The SE-330 IEC 61850 interface supports a total of four simultaneous client connections. Client connection requests are accepted in the order they are received and are available on either network interface.
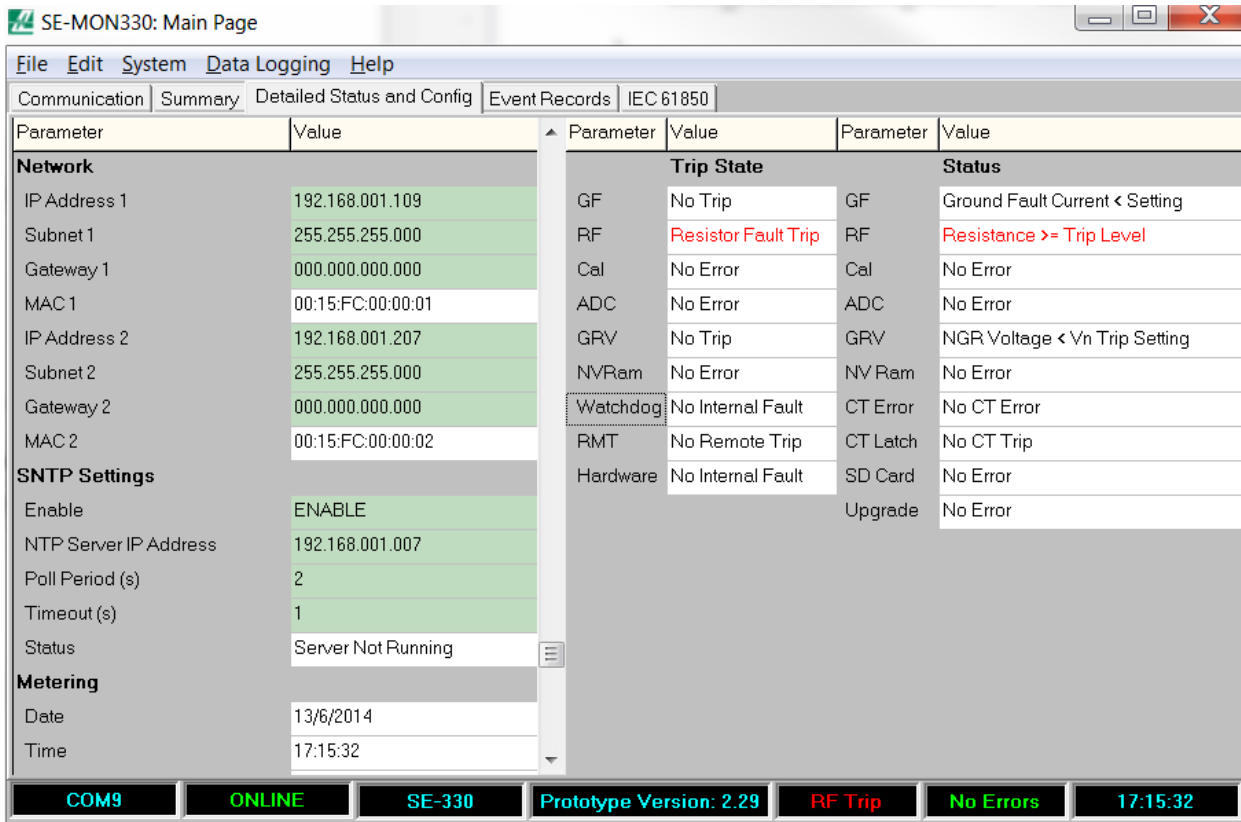
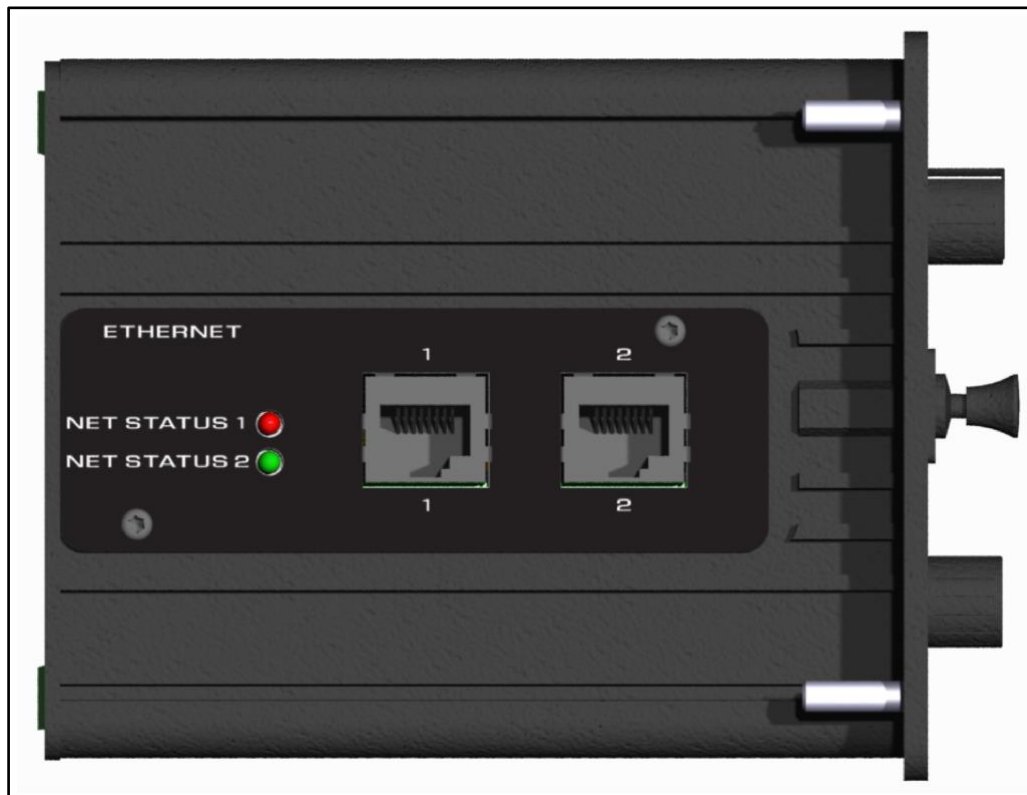FIGURE 1. SE-MON330 Communications Settings.

FIGURE 2. Top View of SE-330 (SE-330-X6-XX) with Dual RJ-45 Ethernet Network Communications.

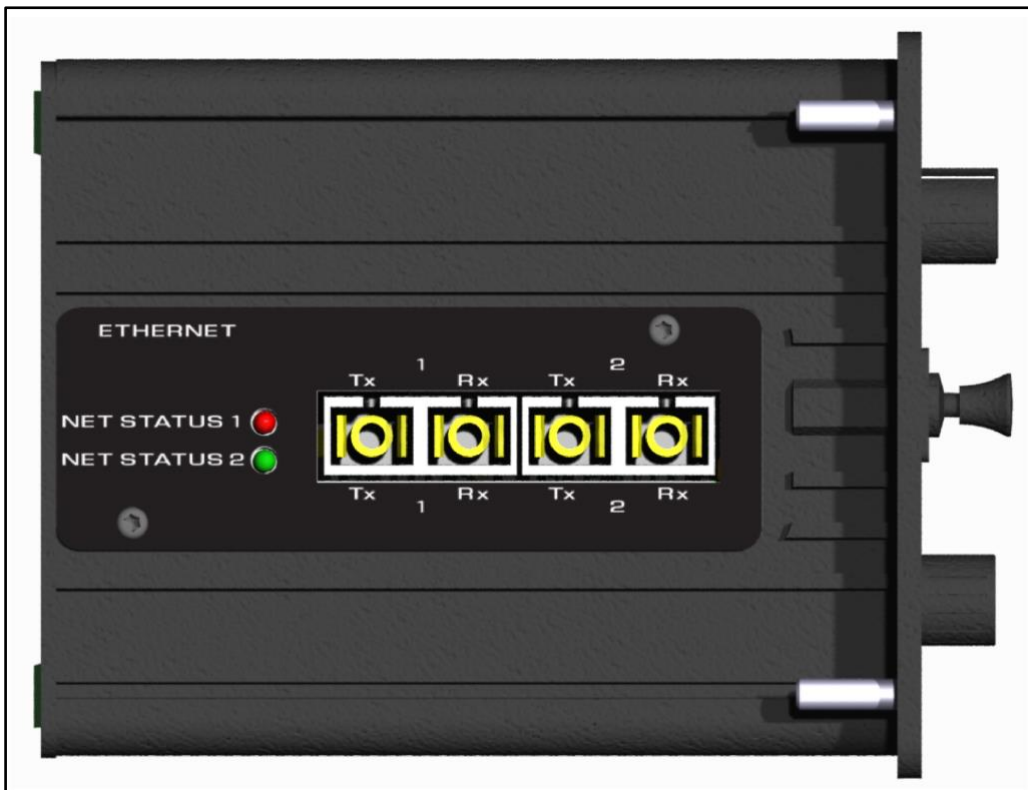FIGURE 3. Top View of SE-330 (SE-330-X7-XX) with Single Fiber SC and Single RJ-45 Ethernet Network Communications.

FIGURE 4. Top View of SE-330 (SE-330-X8-XX) with Dual Fiber SC Ethernet Network Communications.

3. IEC 61850 CONFIGURATION

The SE-330 IEC 61850 interface can be configured with SE-MON330. The configuration can be loaded from an SE-330 or from an ICD configuration file that has been generated in an IEC 61850 system design tool. When the IEC 61850 configuration is ready in SE-MON330, it can be written to the SE-330 or to an ICD file.

IEC 61850 settings are visible in the IEC 61850 tab of SE-MON330 when it is connected to an SE-330 with the optional IEC 61850 interface. When SE-MON330 is first connected, the IEC 61850 fields are empty. The configuration can be loaded from the SE-330 by clicking "Load From SE330" or from an ICD file by clicking "Load From ICD File". The configuration can then be

modified and written to the SE-330 by clicking "Write to SE330", or to an ICD file by clicking "Write to ICD File".

After writing the configuration to the SE-330, cycle SE-330 control power for the settings to take effect.

3.1 SERVER CONFIGURATION

The IEC 61850 server settings are configured through the IEC 61850 Server tab in SE-MON330 as shown in Fig. 5.

The configuration includes the parameters listed in Table 2.

FIGURE 5. SE-MON330 IEC 61850 Server Configuration Tab.

TABLE 2. SERVER CONFIGURATION PARAMETERS

PARAMETER	DESCRIPTION
IED Name	The user-definable name of the SE-330 on the IEC 61850 interface. Limited to 32 characters only.
Check Upper Addresses	Check this option to use the upper addresses including AE Qualifier, Application ID, Presentation Selector, Session Selector and Transport Selector in addition to IP Address and TCP port for connection validation. If unchecked, only the IP Address and TCP port will be used to validate the connection.
AP ID	ACSE Application ID. Integer value between 0 and 65535.
AE Qualifier	OSI ACSE. AE Qualifier. Integer value between 0 and 65535.
Presentation Selector	OSI-PSEL. Presentation Selector. Integer value between 0 and 4294967295.
Session Selector	OSI-SSEL. Session Selector. Integer value between 0 and 65535.
Transport Selector	OSI-TSEL. Transport Selector. Integer value between 0 and 65535.
Keep Alive	The TCP Keep Alive period in seconds. The time it takes to detect a lost connection.
Two Access Points	Check this option to record both network interfaces to the ICD file.

FIGURE 6. SE-MON330 IEC 61850 Report Control Block (RCB) Configuration Tab.

3.2 REPORT CONTROL BLOCKS

The IEC 61850 interface includes four Buffered Report Control Blocks (RCB) and four Unbuffered Report Control Blocks. To configure the RCB's, select the IEC 61850 RCB tab in SE-MON330 as shown in Fig. 6.

RCB's are used for data reporting to clients. Changes made to the RCB configuration through SE-MON330 become the default settings. The RCB can be enabled or disabled through the IEC 61850 interface.

The Data Set to be reported by the RCB is selected in the Data Set field. Fixed or user-defined Data Sets can be selected. See Section 3.3. The Report ID is a text description of the RCB and has a maximum size of 64 characters.

The Config Revision allows the user to maintain control of the configuration revision. In a commissioned system, if the RCB configuration changes, the Config Revision should be incremented.

For buffered RCB's, the Buffering Time can be configured. The default time is 1,000 ms. The minimum time is 0 ms, and the maximum is limited only by the 64 kB buffer memory.

The RCB can be configured to generate a report at specific intervals by setting the Integrity Period to a value other than 0 ms and enabling the Integrity Triggering Option.

RCB's can be configured to generate data reports under the conditions listed in Table 3.

Optional report contents can be configured in the "Option fields" section. The optional fields are listed in Table 4.

TABLE 3. RCB REPORT CONDITIONS

CONDITION	DESCRIPTION
Data Change	The report is sent when any of the Data Attributes of the Data Set associated with the RCB have changed.
Quality Change	The report is sent when the Quality of any of the Data Attributes in the RCB's Data Set have changed.
Data Update	The report is sent when any of the Data Attributes are updated. Data may not change. Timestamp will be updated.
Integrity	The report is sent at regular intervals.
General Interrogation	The client can request the present data values at any time.

TABLE 4. RCB OPTIONAL FIELDS

FIELD	DESCRIPTION
Sequence Number	The integer sequence number. Incremented after each transmission of the report starting with 0 for the first report sent after the RCB is enabled.
Report Timestamp	Timestamp of the report at the time of transmission. Not necessarily the same as the timestamp of the data within the report.
Reason for Inclusion	The trigger condition that caused the report to be sent.
Data Set Name	The name of the Data Set included in the report.
Data Reference	The data reference for the data included in the report.
Buffer Overflow	Indicates a buffer overflow occurred. Only available in Buffered RCB's.
Entry ID	The ID of the report. Only available in Buffered RCB's.
Configuration Revision	The revision of the RCB configuration.

3.3 DATA SETS

Data Sets are used to group elements of the MMS data model for use in RCB's and GOOSE Control Blocks (GCB). Data Sets are viewed and edited using SE-MON330 in the IEC 61850 Data Sets tab as shown in Fig. 7.

The IEC 61850 interface includes three fixed Data Sets, and 29 user-definable Data Sets. The three fixed Data Sets are:

- LLN0$DS1_Measurement Data
    - NGR Voltage
    - NGR Impedance
    - Ground-Fault Current Meter Values
- LLN0$DS2_Record Data
    - Event Record Data for all events that are recorded by the SE-330
- LLN0$DS3_GOOSE
    - Ground-Fault Start
    - Ground-Fault Operate
    - Resistor-Fault Start
    - Resistor-Fault Operate
    - Remote Trip Status

The GCB's are configured to use the LLNO$DS3 GOOSE Data Set. Refer to Section 3.4.1 for more information on the GCB's. For a detailed description of the fixed Data Sets, refer to Section 4.1.2.

User-defined Data Sets can be added through SE-MON330. To add a Data Set open the Data Sets tab and click the "+" button. This will open the Data Set Properties window as shown in Fig. 8. In the Data Set Properties window, assign the Data Set to a Logical Node, give the Data Set a unique name and choose data elements to include in the Data Set. Data elements are chosen from the data-model tree on the left, and can be added to the list on the right by clicking the arrow buttons. Up to 30 data elements can be added. Only data elements with a functional constraint of ST or MX can be included in a Data Set. When a data element has been added to the list on the right, it can be moved up or down in the list with the up and down arrow buttons, or removed from the list with the "X" button.
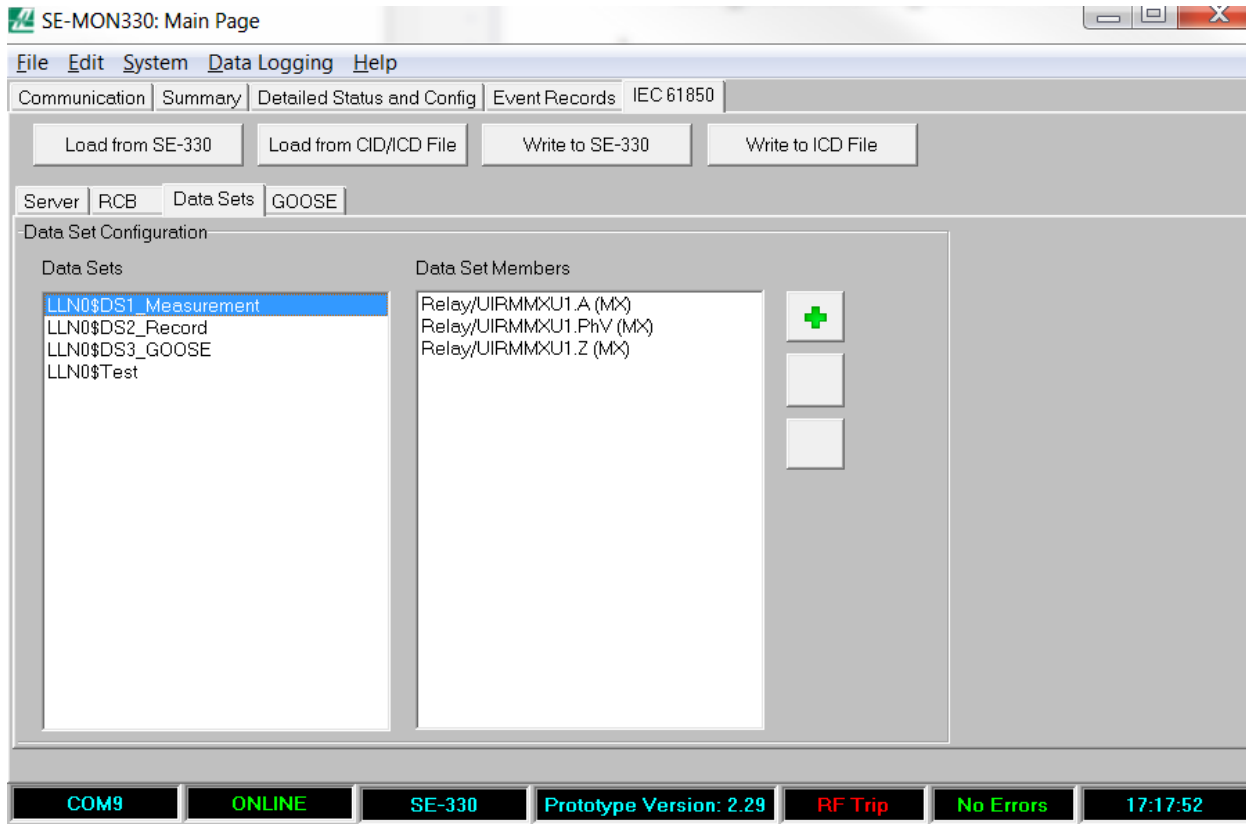

FIGURE 7. SE-MON330 IEC 61850 Data Sets Tab.

FIGURE 8. SE-MON330 IEC 61850 Data Set Properties Window.

3.4 GOOSE SETTINGS

IEC 61850 GOOSE is used to provide network trip and alarm signaling in place of or in addition to traditional relay connections. The GOOSE configuration is viewed and edited in the IEC 61850 GOOSE tab as shown in Fig. 9.

GCB's are configured to publish GOOSE data on the system network. GOOSE Network Inputs are configured to subscribe to GOOSE data that is available on the system network.

3.4.1 GOOSE CONTROL BLOCKS

To support the redundant network interfaces on the SE-330, two GCB's are available. The GCB's can be independently enabled and can be configured to transmit on one or both network interfaces.

Both GCB's transmit the LLN0$DS3_GOOSE Data Set, which includes the Ground-Fault Start, Ground-Fault Operate, Resistor-Fault Start, Resistor-Fault Operate and Remote Trip status. These data elements support network signaling of all SE-330 trip conditions.

The GCB's are configured independently with options for the Destination MAC address, VLAN settings, Application ID, GOOSE ID, Test flag, and Network Interface. The Configuration Revision is not configurable and is fixed at 1.

The Destination MAC address, Application ID and GOOSE ID are used to uniquely identify the source of the GOOSE data. Each of these values is assigned by the system designer in consideration of all GOOSE publishers and subscribers on the network.

The 48-bit MAC address is typically marked as a multicast address by setting the least significant bit of the most significant byte to 1.

The Application ID can be any integer value between 1 and 4095.

The GOOSE ID is a user-definable text identifier. It can contain alpha-numeric characters and underscores and has a maximum length of 64 characters.

VLAN ID and VLAN Priority configure Virtual LAN routing of GOOSE messages through the network. VLAN parameters are assigned by the system designer in consideration of all other traffic on the system network. To disable VLAN support, set the VLAN ID and VLAN Priority to 0.

The GCB can be configured to assert the Test flag which informs subscribers to treat the GOOSE data as a test. How test data is handled in the subscriber is dependent on the specific device, but test data will typically not be used in a trip decision.

The Network Interface can be set to Interface 1, Interface 2 or Interface 1 and 2. When set to Interface 1 and 2, identical GOOSE messages are transmitted simultaneously on both SE-330 network interfaces.

The reception of duplicate GOOSE messages by a subscriber can cause undefined behavior, so the redundant network topology must be considered when configuring the GCB's.

When connected to a subscriber with redundant network interfaces through a fully redundant network, there is no danger of duplicate GOOSE messages being received on either of the subscriber's network interfaces. In this case, a single GCB can be configured to transmit messages on Interface 1 and 2. This configuration can be supported in the subscriber by configuring two Network Inputs, one for each network interface.

When connected to a subscriber with redundant network interfaces through a network on which the GOOSE messages can cross to either side of the network and be received on both network interfaces of the subscriber, the GCB configuration depends on the behavior of the subscriber. In this case, two GCB's can be configured with unique GOOSE configurations to be transmitted on different network interfaces.

3.4.2 GOOSE NETWORK INPUTS

Up to 16 GOOSE Network Inputs are supported. The Network Inputs drive the Remote Trip function within the SE-330.

Network Input parameters must be configured to match the desired GOOSE message. The Destination MAC address, Application ID, Config Revision, and GOOSE ID must all match the corresponding fields in the GOOSE message.

The Network Inputs require a Boolean data attribute. The Boolean data attribute can be received as a single Boolean value, or as a member of a Boolean bit-string. Configure the Data Index to the index of the desired Boolean value in the GOOSE message. The first data element is index 0. If the value is a Boolean bit-string, configure the Bit Index to the index of the desired bit within the bit-string starting with index 0, otherwise set Bit Index to 0.

The Boolean data can be inverted before it is used in the trip decision by setting Inverted to Yes.

For troubleshooting Network Input configurations, the status of each Network Input can be viewed in the IEC 61850 GOOSE tab under NI Status. The Network Input status values are listed in Table 5. The Network Input is colored green when the received value will not cause a Remote Trip, red when the received value will cause a Remote Trip, and yellow when the received value will be ignored due to the Network Input configuration.

FIGURE 9. SE-MON330 IEC 61850 GOOSE Tab.

The Network Inputs are combined in a logical OR operation to drive the Remote Trip function within the SE-330. Disabled Network Inputs and Network Inputs with a status other than OK are not included in the trip decision. The Boolean equation for the trip status of each Network Input is shown in Equation 3.1:

EQUATION 3.1:

$$N_x = E_x \text{ and } [\ (T_x \text{ xor } I_x) \text{ and } R_x]$$

Where:
E_x *is the enabled state of network input x*
(True = enabled)
T_x *is the Boolean data value of network input x*
I_x *is the inverted setting of network input x*
(True = inverted)
R_x *is the state of the connection for network input x (True = Status OK)*
N_x *is the final value for network input x*

Equation 3.2 is the Boolean equation for the combination of the Network Inputs in the Remote Trip decision:

EQUATION 3.2:

$$\text{Remote Trip} = N_0 \text{ or } N_1 \text{ or } ... \text{ or } N_{15}$$

Where:
N_0 *through* N_{15} *are the Network Input values from Equation 3.1*

TABLE 5. GOOSE NETWORK INPUT STATUS VALUES

STATUS	DESCRIPTION
OK	The GOOSE messages are being received within the Time To Live period or the Network Input is disabled.
No Data	No GOOSE messages matching the Network Input configuration are being received.
Old	GOOSE messages have been received in the past, but they are no longer being received.
Bad Type	The Data Attribute specified in the Data Index field is not a Boolean bit-string value.
Test	The Test flag is set on the GOOSE messages.
Needs Commissioning	The Needs Commissioning flag is set on the GOOSE messages.

4. MMS DATA MODEL

The SE-330 IEC 61850 interface includes a single logical device that contains multiple logical nodes. The logical nodes are described in this section.

4.1 DEVICE INFORMATION LLN0

The LLN0 Logical Node contains device information as listed in Table 6.

4.1.1 REPORT CONTROL BLOCKS

The LLN0 Logical Node contains four buffered and four unbuffered RCB's.

RCB's can be configured with SE-MON330 or through the IEC 61850 interface.

Buffered RCB's are named brcb01, brcb02, brcb03, and brcb04, and unbuffered RCB's are named urcb01, urcb02, urcb03, and urcb04.

TABLE 6. LLN0 – LOGICAL NODE DATA

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
Mod	INC	stVal	INT8	Mode for whole logical device (status only): 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
Beh	INS	stVal	INT8	Behaviour reflecting mode for whole logical device: 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
Health	INS	stVal	INT8	The Health value reports the most severe error condition for all Logical Nodes in the Logical Device: 1 OK – No Problems, Normal Operation 2 Warning – Minor Problems, but in Safe Operation Mode - SD Card Full 3 Alarm – Severe Problem, No Operation Possible - ADC Error - NVRAM Error - FLASH Error - Hardware Fault - CT Error - Calibration Error - Firmware Fault
NamPlt	LPL	vendor swRev d configRev ldNS	VS255 VS255 VS255 VS255 VS255	Vendor name: "Littelfuse Inc." Firmware Version Description: "SE-330 Neutral Grounding Resistor Monitor" Configuration Revision Logical Device Name Space "IEC61850-7-4: 2003"

4.1.2 FIXED DATASETS

The LLN0 Logical Node contains two predefined Data Sets with following contents:

Data Set DS1_Measurement
- UIRMMXU1.A (MX)
- UIRMMXU1.PhV (MX)
- UIRMMXU1.Z (MX)

Data Set DS2_Record
- GFPTOC1.Str (ST)
- GFPTOC1.Op (ST)
- RFPTOV1.Str (ST)
- RFPTOV1.Op (ST)
- RecGGIO2.AnIn1 (MX)
- RecGGIO2.AnIn2 (MX)
- RecGGIO2.AnIn3 (MX)
- RecGGIO2.Ind1 (ST)
- RecGGIO2.Ind2 (ST)
- RecGGIO2.Ind3 (ST)
- RecGGIO2.Ind4 (ST)
- RecGGIO2.Ind5 (ST)
- RecGGIO2.Ind6 (ST)
- RecGGIO2.Ind7 (ST)
- RecGGIO2.Ind8 (ST)
- RecGGIO2.Ind9 (ST)
- RecGGIO2.Ind10 (ST)
- RecGGIO2.Ind11 (ST)
- RecGGIO2.Ind12 (ST)
- RecGGIO2.Ind13 (ST)
- RecGGIO2.Ind14 (ST)
- RecGGIO2.Ind15 (ST)
- RecGGIO2.Ind16 (ST)
- RecGGIO2.Ind17 (ST)
- RecGGIO2.Ind18 (ST)
- RecGGIO2.Ind19 (ST)
- RecGGIO2.Ind18 (ST)
- RecGGIO2.Ind19 (ST)
- LLN0.Health (ST)
- LPHD1.PhyHealth (ST)

Data Set DS3_GOOSE
- RFTPOV1.StrVal.general (ST)
- RFTPOV1.Op.general (ST)
- GFTPOC1.StrVal.general (ST)
- GFTPOC1.Op.general (ST)
- CMDGGIO1.SPCSO.stVal (ST)

4.1.3 GOOSE CONTROL BLOCKS

The LLN0 Logical Node contains two GCB's: gcb1 and gcb2. The configuration for gcb1 and gcb2 includes the DS3_GOOSE Data Set which cannot be changed.

4.2 PHYSICAL DEVICE LPHD

The LPHD Logical Node contains the physical device information as listed in Table 7.

TABLE 7. LPHD – LOGICAL NODE DATA

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
PhyNam	DPL	vendor	VS255	Vendor Name: "Littelfuse Inc."
		hwRev	VS255	The Hardware Revision
		swRev	VS255	The Firmware Revision
		serNum	VS255	The Unit Serial Number
		model	VS255	"SE-330" or "SE-330AU" or "SE-330HV"
PhyHealth	INS	stVal	INT8	Physical Device Health: 1 OK – No Problems, Normal Operation 2 Warning – Minor Problems, but in Safe Operation Mode 3 Alarm – Severe Problem, No Operation Possible
Proxy	SPS	stVal	BOOL	TRUE = indicates that the LN is a proxy.

4.3 METERING UIRMMXU1

The Metering Logical Node contains data objects for the three metered values as listed in Table 8.

TABLE 8. METERING UIRMMXU1

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
Mod	INC	stVal ctlModel	INT8	Mode for whole logical node (status only): 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF Status-Only
Beh	INS	stVal	INT8	Behaviour reflecting mode for whole logical node: 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
Health	INS	stVal	INT8	Logical Node Health: 1 OK – No Problems, Normal Operation 2 Warning – Minor Problems, but in Safe Operation Mode 3 Alarm – Severe Problem, No Operation Possible
NamPlt	LPL	vendor swRev d	VS255 VS255 VS255	Vendor Name: "Littelfuse Inc." Firmware Version Description: "Neutral line measurements"
PhV	WYE	neut.cVal.mag.f	FLOAT	Neutral grounding resistor voltage in volts.
A	WYE	neut.cVal.mag.f	FLOAT	Neutral grounding resistor current in amps.
Z	WYE	neut.cVal.mag.f	FLOAT	Neutral grounding resistor resistance in ohms.

4.4 GROUND FAULT GFPTOC1

The Ground-Fault Logical Node contains data elements that are associated with the ground-fault function of the SE-330 as listed in Table 9.

TABLE 9. GROUND FAULT GFPTOC1

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
Mod	INC	stVal	INT8	Mode for whole logical node (status only): 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
		ctlModel		Status-Only
Beh	INS	stVal	INT8	Behavior reflecting mode for whole logical node: 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
Health	INS	stVal	INT8	Logical Node Health: 1 OK – No Problems, Normal Operation 2 Warning – Minor Problems, but in Safe Operation Mode 3 Alarm – Severe Problem, No Operation Possible
NamPlt	LPL	vendor swRev d	VS255 VS255 VS255	Vendor Name: "Littelfuse Inc." Firmware Version Description: "Io>"
Str	ACD	general dirGeneral	BOOL INT8	Start. Ground Fault Condition Detected. Unknown
Op	ACT	general	BOOL	Operate. Ground Fault tripped.
StrVal	ASG	setMag.f	FLOAT	GF Trip Level [A] as configured through the front-panel GF Trip Level dial.
OpDlTmms	ING	setVal	INT32	Operate Delay Time [ms] as configured through the front-panel GF Trip Time dial.

4.5 RESISTOR FAULT RFPTOV1

The Resistor Fault Logical Node contains data elements associated with the Neutral Grounding Resistor (NGR) monitoring function of the SE-330. The data elements are listed in Table 10.

TABLE 10. RESISTOR FAULT RFPTOV1

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
Mod	INC	stVal ctlModel	INT8	Mode for whole logical node (status only): 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF Status Only
Beh	INS	stVal	INT8	Behavior reflecting mode for whole logical node: 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
Health	INS	stVal	INT8	Logical Node Health: 1 OK – No Problems, Normal Operation 2 Warning – Minor Problems, but in Safe Operation Mode 3 Alarm – Severe Problem, No Operation Possible
NamPlt	LPL	vendor swRev d	VS255 VS255 VS255	Vendor Name: "Littelfuse Inc." Firmware Version Description: "Uo>"
Str	ACD	general dirGeneral	BOOL UINT8	Start. Resistor Fault condition detected. Unknown
Op	ACT	general	BOOL	Operate. Resistor Fault tripped.
StrVal	ASG	setMag.f	FLOAT	Resistor Fault trip voltage [V] as configured through the front panel V_N Trip Level dial.
OpDlTmms	ING	setVal	INT32	Operate Delay Time [ms]. Fixed at 12,000 ms.

4.6 COMMAND CMDGGIO0

The CMDGGIO0 Logical Node is used to issue remote trip and remote reset commands. The data elements included in CMDGGIO0 are listed in Table 11.

TABLE 11. COMMAND CMDGGIO0

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
Mod	INC	stVal ctlModel	INT8	Mode for whole logical node (status only): 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF Status-Only
Beh	INS	stVal	INT8	Behavior reflecting mode for whole logical node: 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
Health	INS	stVal	INT8	Logical Node Health: 1 OK – No Problems, Normal Operation 2 Warning – Minor Problems, but in Safe Operation Mode 3 Alarm – Severe Problem, No Operation Possible
NamPlt	LPL	vendor swRev d	VS255 VS255 VS255	Vendor Name: "Littelfuse Inc." Firmware Version Description: "Remote Trip Command"
SPCSO	SPC	stVal Oper.ctlVal ctlModel	BOOL BOOL	Remote Trip Status Set to 1 to issue a remote trip command and to 0 to issue a remote reset command (direct-with-normal-security).

4.7 EVENT RECORD RECGGIO2

The RECGGIO1 Logical Node provides access to the SE-330's event record log. The data elements included in the RECGGIO1 Logical Node are listed in Table 12.

Event records are readable from the RECGGIO1 Logical Node. A BRCB or URCB can be used to send reports for new event records as they are generated. A BRCB will also send reports for all event records recorded since the last power cycle or since the report buffer was last cleared. Event records that were added to the SE-330's internal event record list before the most recent power cycle are not accessible through the IEC 61850 interface.

TABLE 12. EVENT RECORD RECGGIO2

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
Mod	INC	stVal	INT8	Mode for whole logical node (status only): 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
		ctlModel		Status-Only
Beh	INS	stVal	INT8	Behavior reflecting mode for whole logical node: 1 ON 2 Blocked 3 Test 4 Test-blocked 5 OFF
Health	INS	stVal	INT8	Logical Node Health: 1 OK– No Problems, Normal Operation 2 Warning– Minor Problems, but in Safe Operation Mode 3 Alarm– Severe Problem, No Operation Possible
NamPlt	LPL	vendor swRev d	VS255 VS255 VS255	Vendor Name: "Littelfuse Inc." Firmware Version Description: "Recorded Values"
AnIn1	MV	mag.f d	FLOAT VS255	NGR voltage from event in volts. Description: "Recorded NGR Voltage"
AnIn2	MV	mag.f d	FLOAT VS255	NGR current from event in amps. Description: "Recorded NGR Current"
AnIn3	MV	mag.f d	FLOAT VS255	NGR resistance change from event in ohms. Description: "Recorded NGR Resistance"
Ind1	SPS	stVal d	BOOL VS255	Ground Fault Tripped Description: "Recorded value of Ground Fault Trip from trip field status"
Ind2	SPS	stVal d	BOOL VS255	Resistor Fault Tripped Description: "Recorded value of Resistor Fault Trip from trip field status"
Ind3	SPS	stVal d	BOOL VS255	Calibration Error Tripped Description: "Recorded value of Calibration Error Trip from trip field status"
Ind4	SPS	stVal d	BOOL VS255	ADC Error Tripped Description: "Recorded value of ADC Error from trip field status"
Ind5	SPS	stVal d	BOOL VS255	NGR Voltage Fault Tripped Description: "Recorded value of NGR Voltage Fault Trip from trip field status"
Ind6	SPS	stVal d	BOOL VS255	NVRam Error Tripped Description: "Recorded value of NVRAM Error Trip from trip field status"
Ind7	SPS	stVal d	BOOL VS255	Firmware Error Tripped Description: "Recorded value of Firmware Error Trip from trip field status"
Ind8	SPS	stVal d	BOOL VS255	Remote Tripped Description: "Recorded value of Remote Trip from trip field status"

DATA OBJECT NAME	DATA OBJECT TYPE	DATA ATTRIBUTE NAME	DATA ATTRIBUTE TYPE	DESCRIPTION
Ind9	SPS	stVald	BOOL VS255	Hardware Error Tripped Description: "Recorded value of Hardware Error Trip from trip field status"
Ind10	SPS	stVald	BOOL VS255	Ground Fault Exists Description: "Recorded value of Ground Fault from setpoint status"
Ind11	SPS	stVald	BOOL VS255	Resistor Fault Exists Description: "Recorded value of Resistor Fault from setpoint status"
Ind12	SPS	stVald	BOOL VS255	Calibration Exists Description: "Recorded value of Calibration Error from setpoint status"
Ind13	SPS	stVald	BOOL VS255	ADC Error Exists Description: "Recorded value of ADC Error from setpoint status"
Ind14	SPS	stVald	BOOL VS255	NGR Voltage Fault Exists Description: "Recorded value of NGR Voltage Fault from setpoint status"
Ind15	SPS	stVald	BOOL VS255	NVRam Error Exists Description: "Recorded value of NVRam Fault from setpoint status"
Ind16	SPS	stVald	BOOL VS255	CT Error Exists Description: "Recorded value of CT Error from setpoint status"
Ind17	SPS	stVald	BOOL VS255	CT Error Tripped Description: "Recorded value of CT Error Trip from setpoint status"
Ind18	SPS	stVald	BOOL VS255	SD Card Full Error Exists Description: "Recorded value of SD Card full from setpoint status"
Ind19	SPS	stVald	BOOL VS255	Flash Memory Error Exists Description: "Recorded value of Flash Memory Error from setpoint status"

NOTES:

Data Attribute Types:

INT8   8-bit integer value (0-255).
VS255   Variable length ASCII string, maximum
255 characters.
FLOAT   Floating point value, precision matches
IEEE-754 single.
BOOL   Boolean (TRUE or FALSE).

5. SPECIFICATIONS

Protocol ....IEC 61850
Ports..2
IP Addresses ....1 per port
Number of Connections.................4 total
Connectors ....Copper and/or fiber, refer to Figs. 1, 2, and 3 and ordering information in the product manual

Copper:

Connector................................RJ45
Cable......................................CAT5
Length ....100 m (328')
Interface 10BASE-T, 100BASE-Tx

Fiber:

Connector................................SC
Cable......................................SC Multimode
Length....................................2,000 m (6,561') per segment
Interface..................................100BASE-Fx
Center Wavelength ....1300 nm
Operating Wavelength...........1270 to 1380 nm

APPENDIX A
SE-330 SERIES (NEW REVISION) IEC 61850 INTERFACE REVISION HISTORY

MANUAL RELEASE DATE	MANUAL REVISION
December 11, 2017	0-C-121117
June 9, 2014	0-B-060914
March 4, 2014	0-A-030414

MANUAL REVISION HISTORY

REVISION 0-C-121117
  SECTION 2
    Note added.
  SECTION 5
    Specifications updated.

REVISION 0-B-060914
  SECTION 2
    Updated Fig. 1.
  SECTION 3
    Updated Figs. 5, 6, 7, 8, and 9.
  SECTION 4
    Attribute "CtlModel" added.
    Attribute "d" added.
  APPENDIX A
    Updated Revision History.

REVISION 0-A-030414
    Initial release.