# Application Note AN2017-02

# *Monitoring the SEL-2488 Via Simple Network Management Protocol*

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## INTRODUCTION

A supervisory control and data acquisition (SCADA) system installed as part of a substation automation system (SAS) provides monitoring and other required functions for all SAS components, including GPS clocks, servers, gateways, Ethernet switches, firewalls, IEDs, and more. This application note provides a solution to achieve detailed monitoring of an SEL-2488 Satellite Synchronized Network Clock via Simple Network Management Protocol (SNMP) version v2c or v3 over any SCADA system. A typical SEL-2488 connection in an SAS is shown in Figure 1.

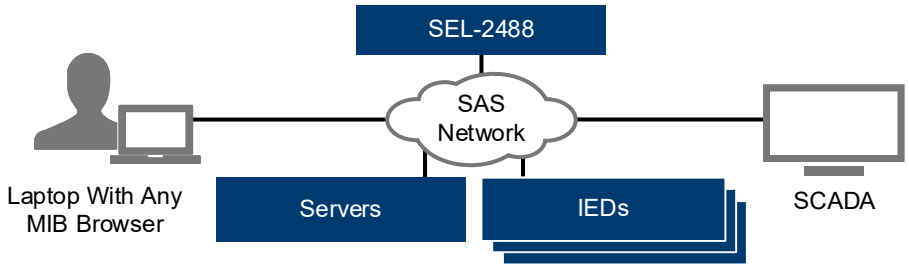


**Figure 1 Typical Arrangement for an SEL-2488 in an SAS**

## PROBLEM

SEL-2488 Clocks have a hardwired alarm contact that can be wired normally open or normally closed, along with one alarm LED on the front. This alarm contact can be used to notify the user of an event by toggling the state of the mechanical contacts. The alarm contact has two levels of alarm severity: major and minor. A major alarm toggles the state of the contact output and latches in that mode until the alarm is acknowledged, while a minor the alarm toggles contact for one second only. Although the alarm state is reported via these contacts, it is not possible to identify the exact cause of an alarm or to quantify the alarm. Therefore, it is not suitable for linking this information to an SAS human-machine interface (HMI) for an operator to view and determine necessary actions.

## SEL SOLUTION

The SEL-2488 can be configured to send SNMP notifications to a central location, such as SCADA, that provides monitoring of all events related to the clock. In order to respond to read requests using SNMP v2c or v3 protocols, the SEL-2488 must be properly configured.

The SNMP configuration for an SEL-2488 can be done via the front Ethernet port or one of the four rear Ethernet ports (the rear ports must be enabled for management access), based on user preference. In order to perform the configuration, the user must log in as an administrator. Once the user is logged in, a list of different settable and viewable parameters is available on the left-hand side. For SNMP-based configuration, the user must click **SNMP** under the **Network Management** heading. The SNMP section is shown in Figure 2.


**Figure 2 SNMP Configuration Tab**

The SNMP section has four tabs: **Configuration**, **Profile Settings**, **Trap Server Settings**, and **MIB Downloads**. To configure the SEL-2488 to respond to SNMP read requests, Profile Settings is the only section that requires configuration. All configured parameters will be displayed under the Configuration tab.

## SNMP Profile Settings

Based on the monitoring requirements, an SNMP v2c- or v3-based profile can be configured. The version can be selected in the **Profile Type** column.

### SNMP v2c Parameters

To configure a v2c profile, set the **Username** and **Community String** parameters. SNMP v2c does not support any authentication or encryption protection. All of these parameters are case sensitive and should be the same as what is set in the SCADA software or any third-party management information base (MIB) browser for the SEL-2488 to successfully respond to read requests.

### SNMP v3 Parameters

A v3 profile requires more parameters to be set than a v2c profile does. In addition to **Username Authentication Protocol**, **Authentication Password**, **Encryption Protocol**, and **Encryption Password** must be set. All of these parameters are case sensitive and should be the same as what is set in the SCADA software or any third-party MIB browser for the SEL-2488 to successfully respond to read requests.

### Enabling SNMP Read Access

Every row in the SNMP Profile Settings tab ends with a check box for enabling read access. If this box is checked, then only the SEL-2488 will be able to respond to SNMP requests for that specific SNMP Profile.

Figure 3 shows a sample configured Profile Settings tab with all available authentication and encryption protocols (available for SNMP v3).

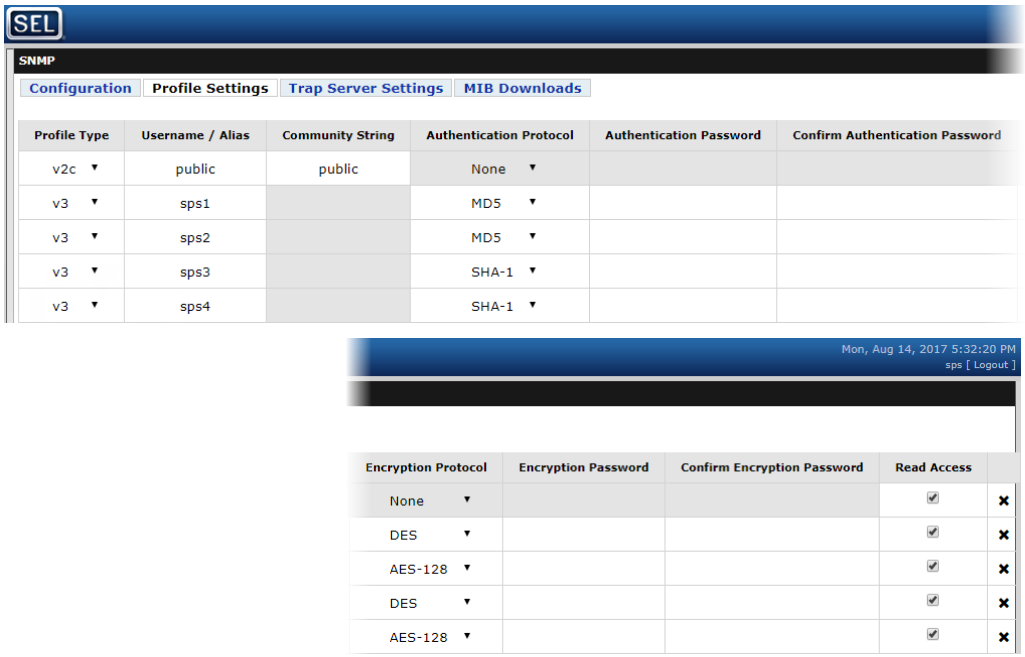


**Figure 3 SNMP Profile Settings Tab**

## Validation

The method described in this application note can be validated by using any SNMP MIB browser. If all of the settings have been configured appropriately, then the SNMP MIB browser can read all of the monitoring signals supported by the SEL-2488 over SNMP with specific object identifiers (OIDs) for each signal (see **Table 1**).

**Table 1 Object Identifiers (OIDs) for Monitoring Signals Supported by SEL-2488**

| Serial Number | Signal Name | OIDs | Syntax |
|---|---|---|---|
| 1 | Antenna status | .1.3.6.1.4.1.31823.1.2488.2.2.1.1.0 | ok(1), short(2), open(3) |
| 2 | Holdover clock | .1.3.6.1.4.1.31823.1.2488.2.2.1.2.0 | ok(1), fail(2) |
| 3 | RAM | .1.3.6.1.4.1.31823.1.2488.2.2.1.3.0 | ok(1), fail(2) |
| 4 | Flash | .1.3.6.1.4.1.31823.1.2488.2.2.1.4.0 | ok(1), fail(2) |
| 5 | Real-time clock | .1.3.6.1.4.1.31823.1.2488.2.2.1.6.0 | ok(1), fail(2) |
| 6 | Battery for real-time clock | .1.3.6.1.4.1.31823.1.2488.2.2.1.7.0 | ok(1), low(2) |
| 7 | LCD status | .1.3.6.1.4.1.31823.1.2488.2.2.1.8.0 | ok(1), fail(2) |
| 8 | Clock internal temperature | .1.3.6.1.4.1.31823.1.2488.2.2.1.9.0 | Integer32 |
| 9 | GNSS Receiver A/B Status | .1.3.6.1.4.1.31823.1.2488.2.2.1.10.1.3.1/2* | ok(1), fail(2) |
| 10 | Power supply ID-A/B | .1.3.6.1.4.1.31823.1.2488.2.2.1.11.1.2.1/2* | Display string |
| 11 | Power supply A/B availability | .1.3.6.1.4.1.31823.1.2488.2.2.1.11.1.3.1/2* | present(1), not present(2) |
| 12 | Power supply A/B model | .1.3.6.1.4.1.31823.1.2488.2.2.1.11.1.4.1/2* | Display string |
| 13 | Power supply A/B serial # | .1.3.6.1.4.1.31823.1.2488.2.2.1.11.1.5.1/2* | Display string |
| 14 | Power supply A/B voltage | .1.3.6.1.4.1.31823.1.2488.2.2.1.11.1.6.1/2* | Integer32 |

| | | | |
|---|---|---|---|
| 15 | Device name | .1.3.6.1.4.1.31823.1.2488.2.1.1.1.0 | Display string |
| 16 | Contact information | .1.3.6.1.4.1.31823.1.2488.2.1.1.2.0 | Display string |
| 17 | Contact location info | .1.3.6.1.4.1.31823.1.2488.2.1.1.3.0 | Display string |
| 18 | Firmware version | .1.3.6.1.4.1.31823.1.2488.2.1.1.4.0 | Display string |
| 19 | Part number | .1.3.6.1.4.1.31823.1.2488.2.1.1.5.0 | Display string |
| 20 | Serial number | .1.3.6.1.4.1.31823.1.2488.2.1.1.6.0 | Display string |
| 21 | Port-1, 2, 3, 4, and F Status | .1.3.6.1.2.1.2.2.1.8.1/2/3/4/5* | up(1), down(2) |
| 22 | Port-1, 2, 3, and 4 PTP State | .1.3.6.1.4.1.31823.1.2488.2.6.1.1.1.2.1/2/3/4* | initializing(1), faulty(2), disabled(3), listening(4), preMaster(5), master(6), passive(7), uncalibrated(8), slave(9) |
| 23 | Constellation-1 and 2 name | .1.3.6.1.4.1.31823.1.2488.2.3.1.4.1.2.1 | Display string (GPS) / (GLONASS) |
| 24 | # of Sat. visible to const-1/2 | .1.3.6.1.4.1.31823.1.2488.2.3.1.4.1.3.1/2* | Unsigned32 |
| 25 | # of Sat. used by const-1/2 | .1.3.6.1.4.1.31823.1.2488.2.3.1.4.1.4.1/2* | Unsigned32 |
| 26 | CPU load | .1.3.6.1.4.1.31823.1.2488.2.7.1.1.0 | % Value |
| 27 | RAM usage | .1.3.6.1.4.1.31823.1.2488.2.7.1.2.0 | % Value |
| 28 | Flash usage | .1.3.6.1.4.1.31823.1.2488.2.7.1.3.0 | % Value |
| 29 | Active web sessions | .1.3.6.1.4.1.31823.1.2488.2.7.1.4.0 | Unsigned32 |
| 30 | System up time | .1.3.6.1.4.1.31823.1.2488.2.7.1.5.0 | Unsigned32 |
| 31 | System power cycles | .1.3.6.1.4.1.31823.1.2488.2.7.1.6.0 | Counter32 |
| 32 | Total run time | .1.3.6.1.4.1.31823.1.2488.2.7.1.7.0 | Unsigned32 |
| 33 | Time source | .1.3.6.1.4.1.31823.1.2488.2.4.1.1.0 | Display string |
| 34 | UTC time offset | .1.3.6.1.4.1.31823.1.2488.2.4.1.2.0 | Display string |
| 35 | DST | .1.3.6.1.4.1.31823.1.2488.2.4.1.3.0 | off(1), inactive(2), active(3) |
| 36 | Time source quality | .1.3.6.1.4.1.31823.1.2488.2.4.1.5.1.3.3 | Display string |

** Forward slash is used to indicate the possible signals and respective options for the last octet of a specific OID.*

## CONCLUSION

The OIDs gathered by the validation process using an MIB browser can be configured in a SCADA database and can subsequently be used over an HMI to achieve SEL-2488 real-time monitoring. The ability of the SEL-2488 to share monitoring signals over SNMP allows real-time monitoring of the SEL-2488 over any SCADA application that supports SNMP v2c or v3. Supporting SNMP v3, allows SEL-2488 monitoring to comply with authentication and encryption requirements.



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