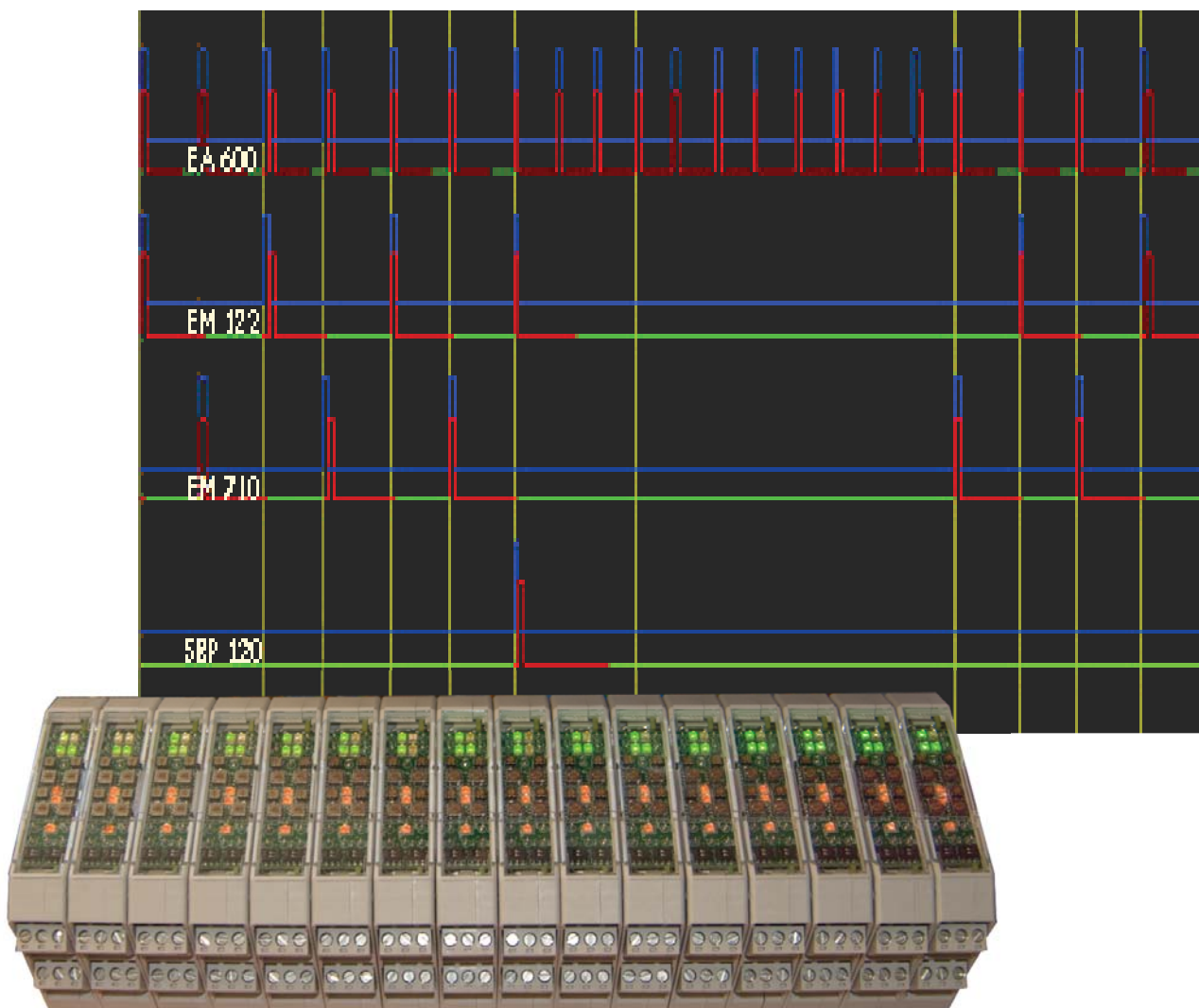




KONGBERG

# Operator Manual

## K-Sync Synchronization Unit







KONGSBERG

# ***KONGSBERG*** ***K-Sync***

## ***Operator Manual***

Kongsberg Maritime

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### Note

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### Warning

*The equipment to which this manual applies must only be used for the purpose for which it was designed. Improper use or maintenance may cause damage to the equipment and/or injury to personnel. The user must be familiar with the contents of the appropriate manuals before attempting to operate or work on the equipment.*

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### Comments

To assist us in making improvements to the product and to this manual, we welcome comments and constructive criticism.

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# SYSTEM DESCRIPTION

## K-Sync

The K-Sync Synchronizing Unit provides highly configurable timing of pinging when multiple echo sounders are employed on a vessel.

The Synchronizing Unit optimizes the timing of each transmit. Optimal timing ensures that echo sounders that may interfere with each other do not transmit concurrently, which could result in acoustic interference and degraded data. The Synchronizing Unit provides simple yet flexible control of scheduling. The trigger schedule can be tailored to the particular type of survey and desired data density collected by each system. Any echo sounder that has a trigger input can be externally triggered by the Synchronizing Unit.

## System overview

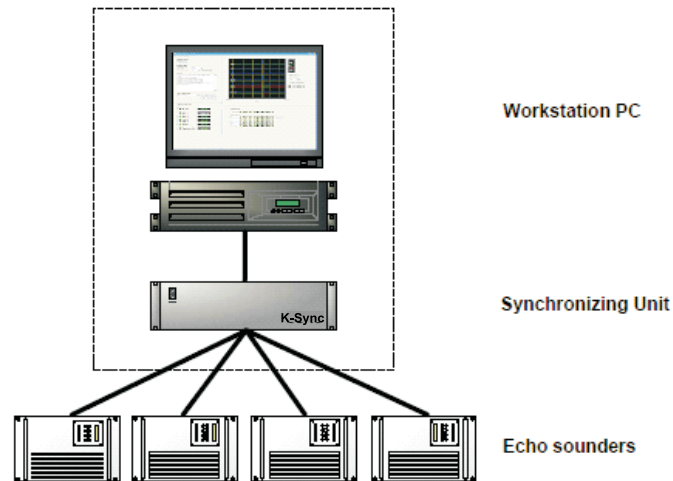
This chapter provides an overview of the K-Sync components and interfaces.

### Main components

The Synchronizing Unit system consists of two main components:

- Workstation PC running the Synchronizing Unit application (K-Sync Application).
- Synchronizing Unit that interfaces with the echo sounders.

Figure 1 The complete synchronizing system



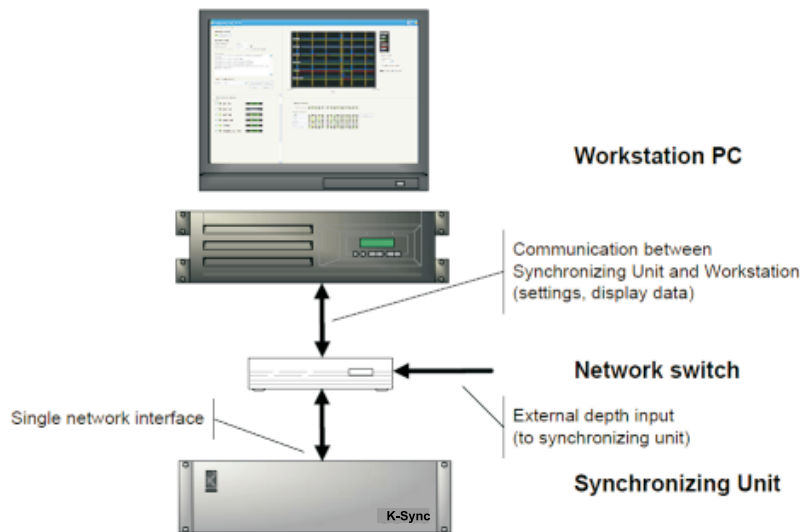
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The K-Sync Application provides the user interface, which allows monitoring of status, modifying settings, trigger schedule as well as performing diagnostics. The application needs to run and be connected to the Synchronizing Unit in order for the system to initialize and be operational. However, once the system is running, the application can be shut down and disconnected while the Synchronizing Unit continues to control the triggering of echo sounders. The echo sounders are interfaced directly to the Synchronizing Unit as depicted in figure *The complete synchronizing system* on page 8

## Network Interface

A single network interface exists between the Workstation and the Synchronizing Unit. The interface allows the application to initialize the Synchronizing Unit and to display status during operation. See figure *The Workstation and the Synchronizing Unit* on page 9

Figure 2 The Workstation and the Synchronizing Unit



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The Workstation and the Synchronizing Unit are interfaced via a network connection.

The Synchronizing Unit can also receive depth data from echo sounders and other external sources. Depth is transmitted as datagrams (via UDP) directly to the Synchronizing Unit. A network switch is required if external depth is supplied.

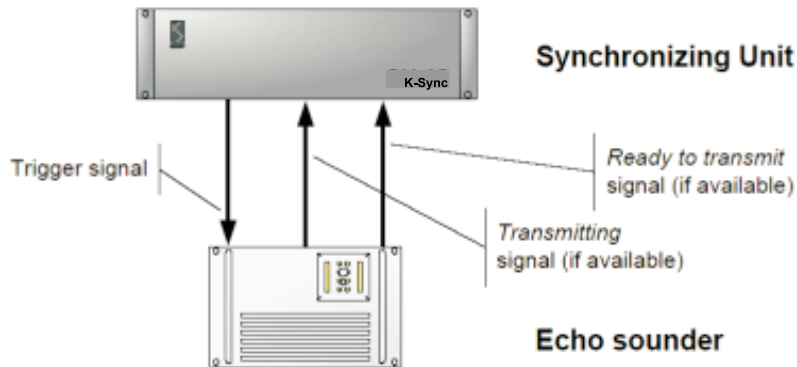
## Signal Interface

The Synchronizing Unit controls pinging and receives status from the echo sounders via the signal interface. A trigger output is provided for each echo sounder as well as inputs for receiving feedback signals from echo sounders. See figure *The Synchronizing Unit* on page 10.

The Synchronizing unit provides one output and two inputs for each echo sounder:

- Trigger signal (output): tells the echo sounder when to transmit.
- Ready to transmit signal (input): communicates when the echo sounder is ready for next trigger.
- Transmitting signal (input): tells the Synchronizing Unit when the echo sounder has started transmitting.

Figure 3 The Synchronizing Unit



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The Synchronizing Unit can utilize feedback signals from echo sounders in order to perform optimal synchronization.

Feedback signals are not required, but should be used when available. If feedback signals are not available, the operator can estimate the waiting period required for the echo sounder to become ready.

## Concept of Operation

The Synchronizing Unit schedules the echo sounders to transmit according to trigger groups. There are a total of 16 trigger groups and any number of echo sounders (or none) can be assigned to a group. Each group is triggered consecutively, while the echo sounders assigned to a group are triggered together. Once it is determined (by reading feedback signals) or estimated (based on user settings) that all echo sounders in the current group have completed their ping cycle, then the next group is triggered. All groups are triggered in round-robin fashion. The duration of each group is not fixed and depends upon what the maximum active period is for the echo sounders in that group.

Echo sounders can be taken out of the schedule without changing the group schedule, simply by disabling them. If a group does not contain any available echo sounders, then that group is skipped.

If the ready to transmit feedback signal is available, then the duration of the active period is as long as the time it takes for the signal to become active after the echo sounder has been triggered.

If the transmitting feedback signal is available, the Synchronizing Unit will automatically check that a transmit occurred after each trigger. If the echo sounder fails to transmit three times in a row, it is assumed that it has been turned off and it is then taken out of the schedule.

It is possible to ignore the feedback signals by specifying either **Calculated** or **Fixed Period** trigger modes (see section *Trigger Modes* on page 44).

## Workstation requirements

The following are the system requirements for the Workstation:

- Windows 7 (32 or 64-bit) or Windows 10
- 32 or 64-bit Intel or AMD processor, 2 GHz or higher
- 8GB RAM
- 1x 100 Mbps network interface card
- 256 GB HD
- Recommended screen resolution is 1280x1024 or larger

## Reference

K-Sync Installation Manual, 342741

Operator Manual EM Series Datagram Formats, 850-160692

# SYSTEM INSTALLATION

## Overview

- Getting the K-Sync operational requires setting up the Workstation as well as configuring the Synchronizing Unit. The procedure for installing the hardware is covered in the *K-Sync Installation manual - Document number 342741*:
  - An overview of all the steps necessary to perform installation from start to finish is outlined in the chapter *Installation Procedures*.
  - The software installation of K-Sync Application is covered in the section *Installing the K-Sync application software*.
- The Synchronizing Unit is configured via the K-Sync Application running on the Workstation. The configuration of the Synchronizing Unit is explained in *SYSTEM CONFIGURATION* on page 14 in this manual.

This chapter assumes that the necessary cabling and hardware connection have been completed. Also that the I/O modules have been properly configured.

## Workstation Setup

Set up of Workstation includes configuration of the network card and installing the Workstation software.

### Network Configuration

The IP address of the Synchronizing Unit is by default 157.237.60.169 with a subnet mask of 255.255.240.0. It is highly recommended to use this configuration to make any possible future troubleshooting or support easier. If it is necessary to change the IP address in order to better work with existing network infrastructure, the network configuration can be modified (see Installation Manual). The IP address that the K-Sync Application expects to find the K-Sync at can be found in the **System Settings** dialog in the application.

It is recommended that the Workstation has a dedicated network interface to connect with the Synchronizing Unit, especially if the Workstation is simultaneously used for other purposes. A dedicated network connection will ensure that displays and controls are responsive and have minimal latency.

## Workstation Software/K-Sync application Installation

### How to install the application

- 1 Run the `Setup.exe` file from the K-Sync Installation CD.
- 2 Follow the installation setup prompts.

#### Caution

---

*Always power up the Synchronizing Unit before echo sounders are turned on to avoid accidental pinging. Trigger outputs are undefined during power-up (first 20 seconds) and signal levels could potentially be interpreted as trigger pulse by the echo sounders until signal levels have settled.*

---

Proper installation can be verified by:

- 1 Make sure echo sounders are turned off or at least pinging/external trigger is turned off to avoid any spurious triggering during power-up.
- 2 Turn on the power to the Synchronizing Unit.
- 3 Open the application (**Start menu** → **All Programs** → **Kongsberg Maritime** → **K-Sync Application** on the Workstation.
- 4 Once that application has started, the status in the application window will indicate whether a connection has been established with the Synchronizing Unit within about 10 seconds.

#### Note

---

*The user interface will be grayed out whenever the K-Sync Application is unable to communicate with the synchronizing unit.*

---

# SYSTEM CONFIGURATION

## Overview

Configuration of the Synchronizing Unit is performed once installation has been completed as described in the previous chapter.

The system and installation settings are primarily configured during initial installation. The installation settings specify which echo sounder systems are installed and how the signal interface interprets and generates individual trigger signals. The system settings configure the depth input and sound speed. All settings are permanently stored on the Workstation and uploaded to the Synchronizing Unit each time a connection is made after power-up.

## System settings

**System settings** dialog permits modification of settings related to external depth and sound speed used for travel time calculations.

The Synchronizing Unit is capable of receiving external depth datagrams sent over Ethernet. The settings for defining UDP receive port and datagram types are available in the **System Settings** dialog. Click on **Settings** from the application menu and select **System settings...** to open the **System Settings** dialog.

Sound speed is used for estimation of travel time. If any of the echo sounders have trigger mode set to calculated, then an approximate sound speed must be entered.

### Note

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*System settings are stored in config directory in the program folder as an XML file: **config\system settings.xml**.*

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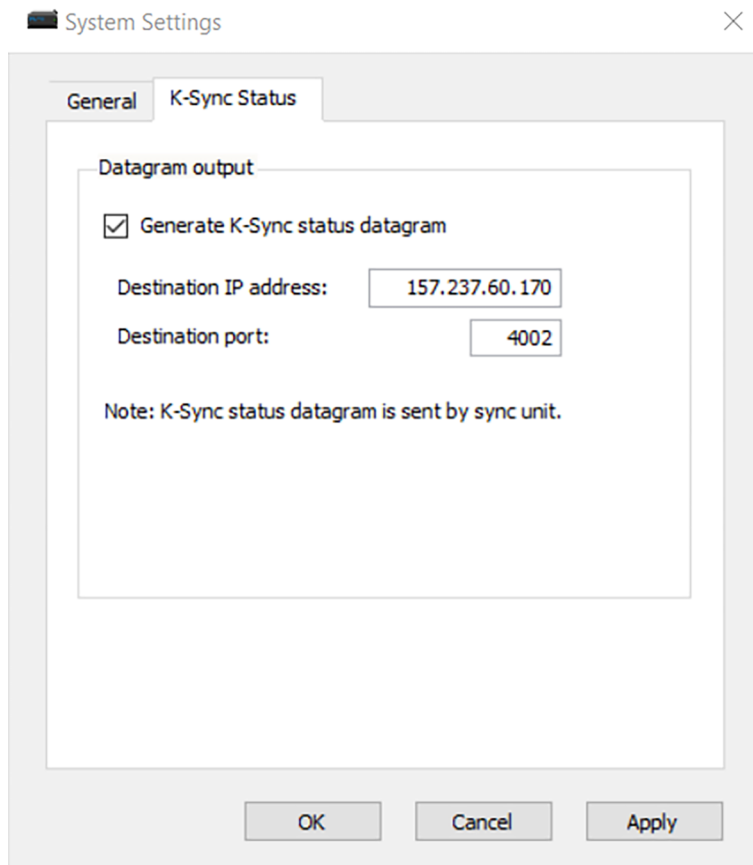
Figure 4 System settings - General

The screenshot shows a window titled "System Settings" with a close button (X) in the top right corner. The window has two tabs: "General" (selected) and "K-Sync Status". The "General" tab contains three sections of settings:

- Network settings:** A text box labeled "Synchronizing unit IP address:" with the value "157.237.60.169".
- Depth datagram input:** A text box labeled "UDP receive port:" with the value "4502", and a dropdown menu labeled "Depth datagram ID:" with the value "EAX". Below these is a note: "Note: Depth datagrams are received by synchronizing unit."
- Estimation of travel time:** A text box labeled "System sound speed (m/s):" with a spinner control set to "1500" and the unit "m/s". Below this is a note: "Note: Only used for round trip time calculations for systems that use 'Calculated' operational mode."

At the bottom of the dialog are three buttons: "OK", "Cancel", and "Apply".

Figure 5 System settings - K-SYNC Status



## Network settings

The **Synchronizing unit IP address** is entered in the **System settings** dialog. This setting must match the IP address of the synchronizing unit for the application to connect.

The IP address of the synchronizing unit is specified here. This address should normally be 157.237.60.169, unless the synchronizing unit IP was set differently during installation (see *Installation Manual*). After changing the IP address in the K-Sync application, the application should be restarted and one should verify that communication with synchronizing unit is functioning (LED in system control turns green or yellow).

## Depth datagram input

The Synchronizing Unit can receive depth data from external sources. Depth data is sent as datagrams directly to the Synchronizing Unit.

In order to receive depth externally, a network switch must be interfaced between the Workstation and the Synchronizing Unit as the latter has only one Ethernet connection.

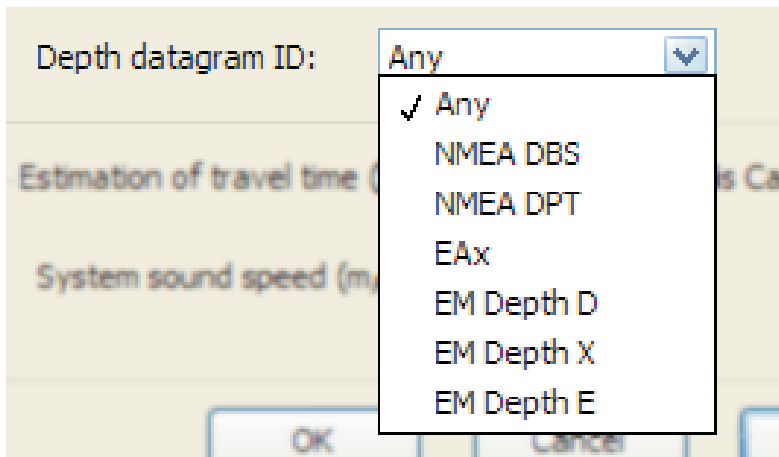
The **UDP receive port** for receiving depth datagrams can be modified to any value equal or greater than 1024 and less than 65535.

**Depth datagram ID:** The Synchronizing Unit can be set to receive any one of the supported datagram types or only one specific type (see figure *Depth datagram ID* on page 17).

The datagrams that are supported are:

- NMEA depth (DBS, input datagram)
- NMEA DPT (input datagram)
- EAx: Single beam depth (EA 500 input datagram)
- EM Depth 'D': Multibeam depth (e.g. EM 120, EM 1002, EM 3000, EM 3002)
- EM Depth 'X': Multibeam depth (e.g. EM 122, EM 710)
- EM Depth 'E': Single beam depth (e.g. EA 600)

*Figure 6 Depth datagram ID*



Depth datagram ID selection in **System Settings** dialog.

Refer to Operator Manual EM Series Datagram Formats, 850-160692, Rev M, for detailed description of depth datagrams.

## Estimation of travel time

The System sound speed setting is used for roundtrip time calculation when the operating mode for an echo sounder is set to calculated. Since the setting only affects timing estimates, it is not critical for the value to be continuously updated or be exact. The value should be an average of the profile down to bottom. If the global mean of the sound speed is known, that value can be used.

## Datagram output

Trigger status from synchronizing unit can be provided to other multibeam workstations running Kongsberg software. This requires that:

- Seafloor Information System (SIS) software V3.8 or higher is already installed on echo sounder workstation

- The echo sounder workstation and the synchronizing unit exist on the same subnet

**Generate K-Sync status datagram:** No configuration is necessary in the SIS software. By enabling the status datagram in the **K-Sync Status** tab, the status is forwarded to the SIS workstation.

The **Destination IP address** must be set to the IP of SIS workstation and **Destination port** must be set to 4002.

When the SIS software receives the status, the trigger event of each echo sounder is shown on the bottom of the numerical display as separate LEDs in real-time (see figure *K-Sync status SIS4* on page 18). This feature ensures that the synchronizing unit is triggering each enabled echo sounder as the operator can easily notice if a system has timed out while surveying.

K-Sync status is shown at the bottom of the numerical display in SIS. The terms seen in the K-Sync Application window are in parenthesis.

Color	Description
Dark green	Echo sounder is ready (active), but not currently pinging
Green (SIS4)	Echo sounder is pinging (busy)
Blue (SIS5)	Echo sounder is pinging (busy)
Yellow	Echo sounder is unavailable (standby)
Gray (no color)	Echo sounder is not in use (disabled)

Figure 7 *K-Sync status SIS4*

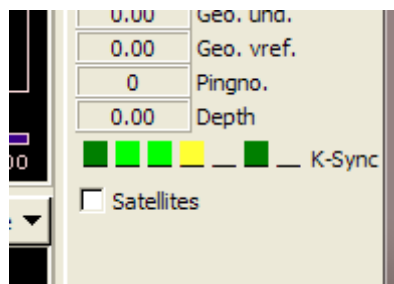


Figure 8 *K-Sync status SIS5*

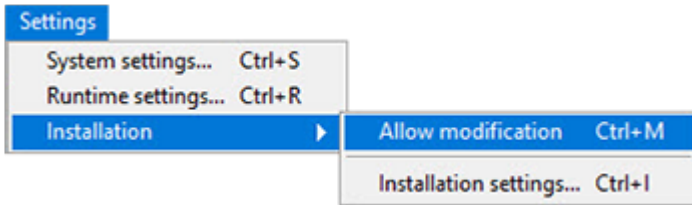


## Installation Settings

This section discusses the installation settings and is applicable to initial installation and when adding and removing echo sounders at a later time. Normally, it should not be necessary to change existing settings unless timing or signal characteristics have changed for a particular echo sounder (e.g. due to an upgrade of echo sounder).

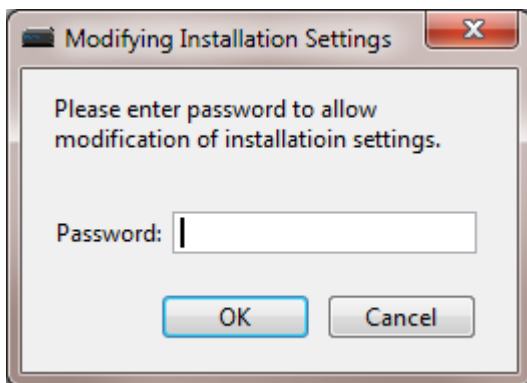
Installation settings are accessed from the application menu under **Settings** → **Installation** → **Installation settings**. After starting the application the option is grayed out until the menu item **Allow modification** is selected and correct password is provided.

Figure 9 Allow modification



The default password is `simrad0`.

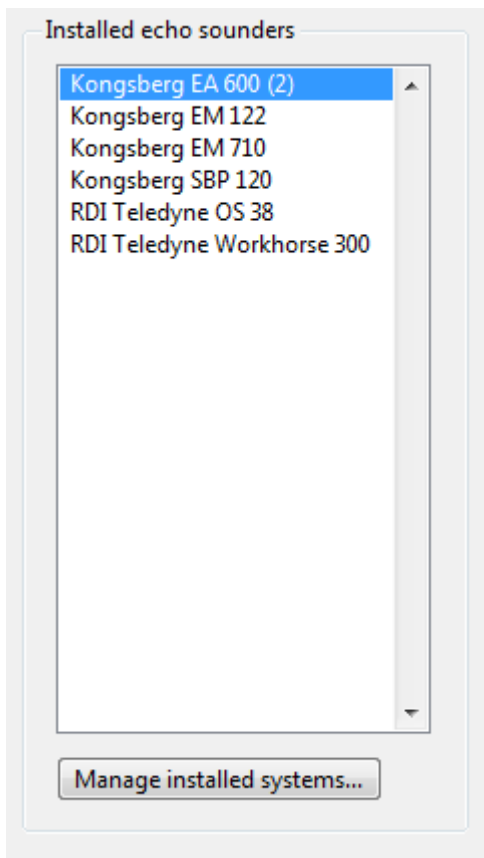
Figure 10 Password dialog



## Managing Installed Systems

The Echo sounder systems to be controlled may already have been imported into the K-Sync Application during the installation. If not, then new systems can be added via the **Installation Settings** dialog and selecting the **Manage installed systems** button.

Figure 11 Installation Settings - Manage Installed systems button

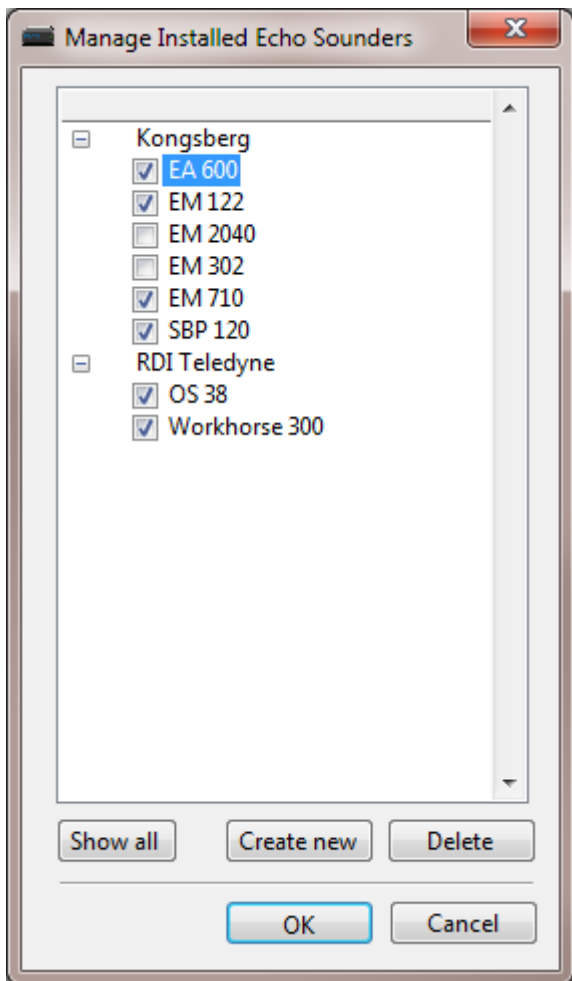


Open the **Installation Settings** dialog on the **Settings** menu, or press ctrl+i.

Select the **Manage installed systems** button.

This dialog will allow new systems to be added or current ones to be deleted (see figure on page ). All systems will be listed in alphabetical order in user interface (such as the echo sounder status area and trigger display). If echo sounder to be added is not available from the list, it can be created by clicking the **Create new** button and entering make and model in the dialog that appears (not shown).

Figure 12 Manage Installed Echo Sounders dialog



## Configuring signal interface

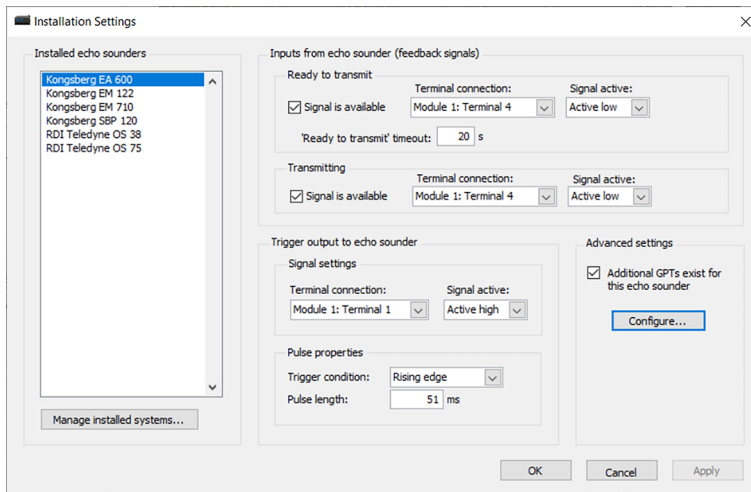
The installation settings specify the parameters for the input and output signals between the Synchronizing Unit and the echo sounders:

**Feedback signals (from echo sounder):** are signals that communicate if echo sounder is ready and when a transmit occurs. An echo sounder may or may not provide these signals.

**Trigger pulse (generated by Synchronizing Unit):** signals the echo sounder to transmit. The echo sounder must explicitly be configured for external trigger mode to enable external trigger. Usually an echo sounder will transmit at the same instant as the pulse is received. However a few echo sounders will have an inherent delay or even a variable delay prior to transmitting.

The installation settings are modified in the **Installation Settings** dialog:

Figure 13 Installation settings dialog



The system to be modified can be selected in the Installed systems frame by clicking on its name. The current system being edited is the one highlighted. Once changes have been made to a particular system, press **Apply** to confirm the changes. If apply is not selected after changes are made, a dialog will prompt for confirmation before switching to a different echo sounder. To undo incorrect changes simply click **Cancel** and dialog will close and uncommitted settings will be discarded.

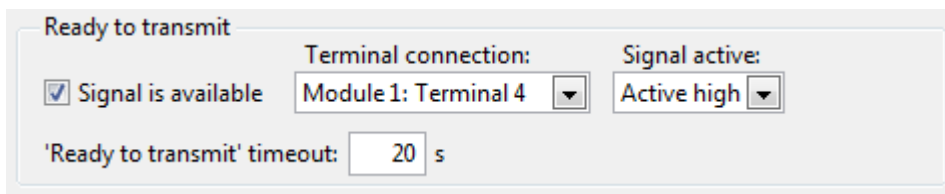
An overview of ping cycle, corresponding signals and trigger display can be found in Appendix A.

## Feedback signals (from echo sounder)

The feedback signals communicate whether an echo sounder is ready to be triggered, and if transmit occurred.

### Ready to transmit

Figure 14 Installation settings - Ready to transmit



When the ready to transmit signal is active, the Synchronizing Unit can trigger the echo sounder. Once the ping cycle starts, it is required that the signal go inactive. Once ping cycle is complete and echo sounder is ready again, the signal must once again become active. It also works well if echo sounders keep this signal inactive when they are not configured for external pinging as they will instantly be placed into *standby* (see section *Echo Sounder status* on page 40 for more information). This signal is referred to as RTS in Kongsberg installation manuals.



## Transmitting

Figure 15 Installation settings - Transmitting

The screenshot shows a configuration window titled "Transmitting". It contains three main elements: a checked checkbox labeled "Signal is available", a dropdown menu for "Terminal connection" currently showing "Module 1: Terminal 4", and another dropdown menu for "Signal active" currently showing "Active low".

This signal goes active at the instant when the transmit pulse starts. It is not required that the pulse length of this signal be the same as the transmit pulse itself.

If the signal is available, the trigger display will show a red pulse whenever the echo sounder transmits. Even if the echo sounder is not controlled by the Synchronizing Unit, a red pulse will appear whenever the transmitting signal is set by echo sounder. If an echo sounder fails to transmit three times in a row upon being triggered, the Synchronizing Unit will assume that the echo sounder is no longer available. The echo sounder is assumed to be not responding if it has not transmitted within 512 ms of trigger. In this case it will be put into Standby and the system will not be triggered by the Synchronizing Unit until the operator disables and re-enables the system in Echo Sounder Status (see section *Echo Sounder status* on page 40).

It is also possible to ignore feedback signals for a given echo sounder by selecting Calculated or Fixed trigger modes (see section *Trigger Modes* on page 44 for more information).

## Trigger output (to echo sounder)

Figure 16 Installation settings - Trigger output

The screenshot shows a configuration window titled "Trigger output to echo sounder". It is divided into two sections: "Signal settings" and "Pulse properties". In the "Signal settings" section, there is a dropdown for "Terminal connection" set to "O00 - Module 1 (P3:1)" and another dropdown for "Signal active" set to "Active high". In the "Pulse properties" section, there is a dropdown for "Trigger condition" set to "Rising edge" and a text input for "Pulse length" set to "10 ms".

The trigger output is a pulse generated by the Synchronizing Unit to signal the echo sounder to ping. The pulse width can be specified in 1 ms increments.

**Note**

---

*There are wide differences among echo sounders in their implementation of the signal interface. Consult the product manual for the individual systems for specific information on timing and signal specification.*

---

## Specific signal settings

The following settings are available for ready to transmit and the transmitting feedback signals:

- **Signal is available:** If the echo sounder provides a particular feedback signal, then this checkbox should be checked. If enabled, this setting will also make certain runtime settings available (see section *Runtime settings* on page 42).
- **Terminal:** This is the ID of the hardware connection inside the Synchronizing Unit. There are 48 digital inputs available, numbered I00 to I47.
- **Signal active:** This setting specifies whether the input/output is active high or active low. See table on page for the actual voltage levels associated with this setting. The level also depends on whether the input has been configured for TTL or RS-232 signal level.

To illustrate, if the manufacturer specifies that the ready to transmit signal is TTL and active when voltage is +5V, then from the table below, the signal active should be configured as active high. Likewise, an RS-232 signal that is specified to be active when voltage is > +3V should be configured as active low (as RS-232 signals are inverted internally).

*Table 1 Signal type*

Signal type (hardware setting inside SU)	Active state Setting Logic state	Active low	Active high
TTL	Inactive	+5 V	0 V
	Active	0 V	+5 V
RS-232	Inactive	<-3 V (-12V)*	>+3 V (+12V)*
	Active	>+3 V (+12V)*	<-3 V (-12V)*

\* For trigger outputs the RS-232 levels are either +12 V or -12 V.

The corresponding voltage level of each signal depends upon whether the signal is TTL or RS-232 coming out of the Synchronizing Unit (this is a hardware configuration inside the unit).

**Note**

---

*RS-232 refers in this document only to RS-232 signal level as no data is actually transmitted.*

---

- **Ready to transmit timeout** (Ready to transmit feedback signal only): This settings specifies how long the Synchronizing Unit should wait for the echo sounder to become ready after it has been triggered. If the echo sounder does not become ready within this period, then it will be ignored in the schedule until it is ready again (put into standby. Refer to Section 4.6). Use a value that is at least as long as the longest expected period between pings at maximum survey depth.

The trigger pulse has some additional parameters that can be set:

- **Trigger condition:** Specifies the edge that the echo sounder will trigger on. This should in most instances be set to rising edge. Valid values are either rising edge, or falling edge.
- **Pulse length:** The width of the generated trigger pulse. For most systems this can be set to 10 ms. Valid range is 1 to 1000 ms

Tip

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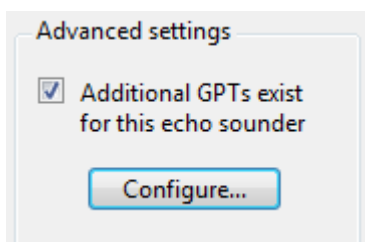
The signal active should normally be set to *high* if TTL level and *low* if RS-232. Rising/falling edge setting will then refer to actual rising/falling edge with respect to voltage (as opposed to logic level).

---

## Configuration of GPTs and WBTs

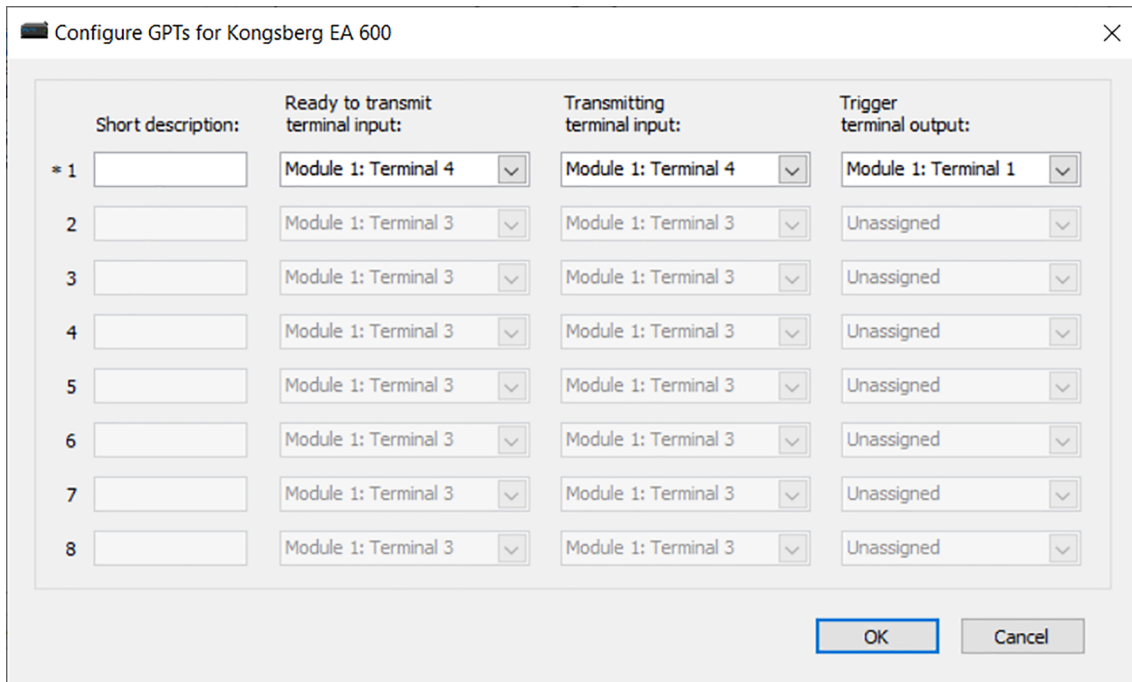
The configuration of GPTs (General Purpose Transceivers) and WBTs (Wide Band Transceivers) settings are applicable to echo sounders that are always triggered together but have individual feedback signals. For example, the different Kongsberg EA and EK models GPTs and WBTs should be configured as Additional GPTs under **Advanced** in the **Installation Settings** dialog.

*Figure 17 Installation settings, Advanced settings*



By configuring the echo sounders as a group, they can be controlled together. This means that only one checkbox is used to control a group of GPTs. The GPTs are configured the same way as the regular echo sounders. The signal configuration in the **Installation Settings** dialog will apply to each of the GPTs (i.e. ready to transmit, transmitting, and trigger signals). Each of the transceivers is labeled with a descriptive name (i.e. the transmit frequency) that is shown in the echo sounder status and trigger plot.

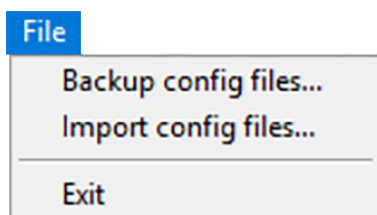
Figure 18 Configure GPTs dialog box



## Backing up and importing configuration files

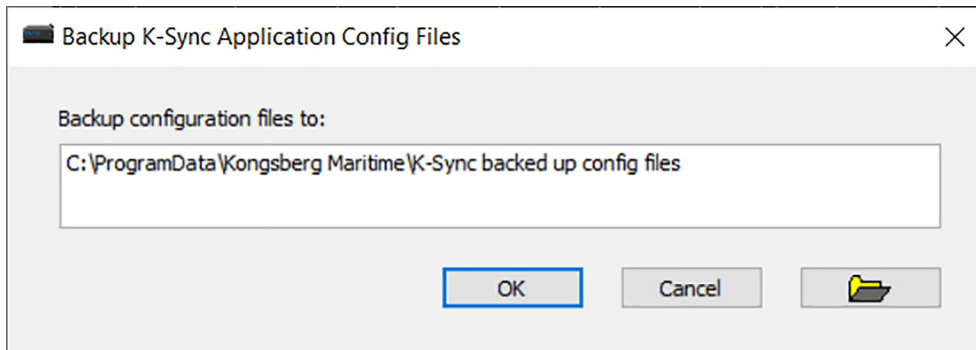
### Backing up K-Sync configuration files

All settings that are used by the K-Sync Application can be backed up as a ZIP file archive. This will backup all system, installation and runtime settings that are in use at any given point in time.



### Back up configuration files

- 1 Select **File** → **Backup config files...**
- 2 In the **Backup K-Sync Application Config Files** dialog

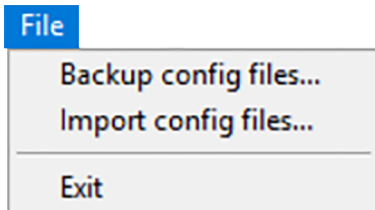


- a Optional: click the folder icon to select the folder to save archive to. By default, the archive will be saved to: C:\ProgramData\Kongsberg Maritime\K-Sync backed up config files.
  - b Optional: if you want to save to a custom file name, enter the filename in the dialogue that appears when clicking the folder icon. Make sure that the filename has extension .kcfg.zip. By default, the filename will contain the date and time.
- 3 Click OK to backup to the selected folder/archive.

#### Note

*In the same folder there are also backed up config files that are backed up during upgrade (by application installer). These files are saved to individual folders instead of ZIP files.*

## Importing K-Sync configuration files



### Import (restore) configuration files

- 1 Go to **File** → **Import config files...**
- 2 In the **Import K-Sync Application Config Files** dialog:
  - a Click the folder icon
  - b Select the ZIP file archive to import. By default they are located in C:\ProgramData\Kongsberg Maritime\K-Sync backed up config files
  - c Click OK
- 3 Click OK to import.

When importing configuration files the existing configuration profile will be selected (if available in the imported config file archive). Otherwise, the default profile will be loaded.

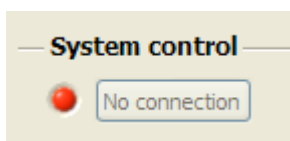
# QUICK START GUIDE

This chapter provides a quick overview of how the synchronizing unit is started and some basic explanations of the main controls and status.

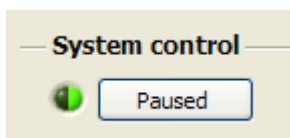
## How to get started

- 1 Power up the Synchronizing Unit. The synchronizing unit will be ready within 30 seconds.
- 2 Launch the K-Sync Application on workstation.
- 3 Wait for main window to launch. Meanwhile, the splash screen will convey status during initialization and if the application is able to connect to the synchronizing unit.
- 4 Wait for the application to connect to the Synchronizing Unit. The LED indicator in the top left corner (System Control) will remain red until successful connection with Synchronizing Unit. The LED will then blink green. A blinking green LED means the system is currently paused (no triggering), which is the default state after unit is powered up.

*Figure 19 System control, not connected*



*Figure 20 System control, paused (green LED is blinking)*

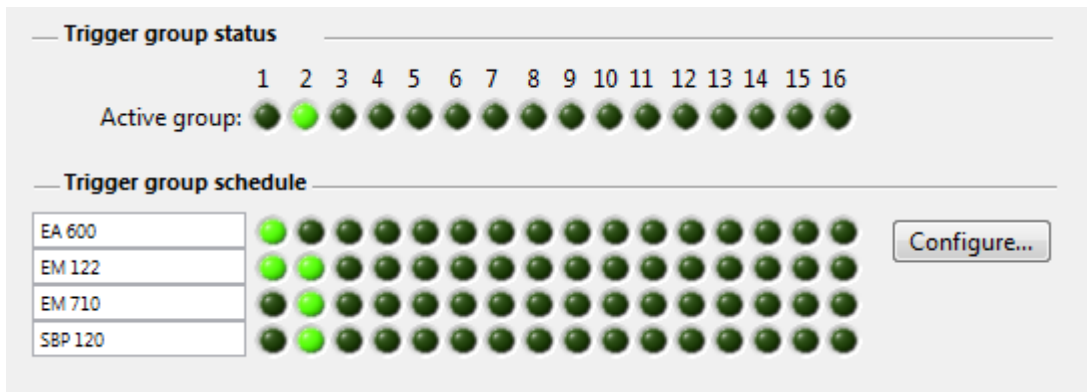


See section *System control* on page 34 for more information about the **System Control** area of the application window.

- To edit the trigger groups, click the **Configure** button next to the trigger groups. Select the echo sounders to be scheduled for each group. At least one group must contain an active echo sounder in order for triggering to occur.

The Trigger Status shows which echo sounder is assigned to which groups.

Figure 21 Trigger Status



- Once a system is triggered, the Echo sounder status will show a green LED for the duration of the active period (next to checkbox). **ACTIVE** means the echo sounder is ready and will ping whenever triggered. **STANDBY** means the echo sounder is not ready due to timeout (see status log for specific reason). **DISABLED** simply means the echo sounder is disabled in the K-Sync by user (checkbox unchecked).

Figure 22 Echo sounder status for one particular echo sounder

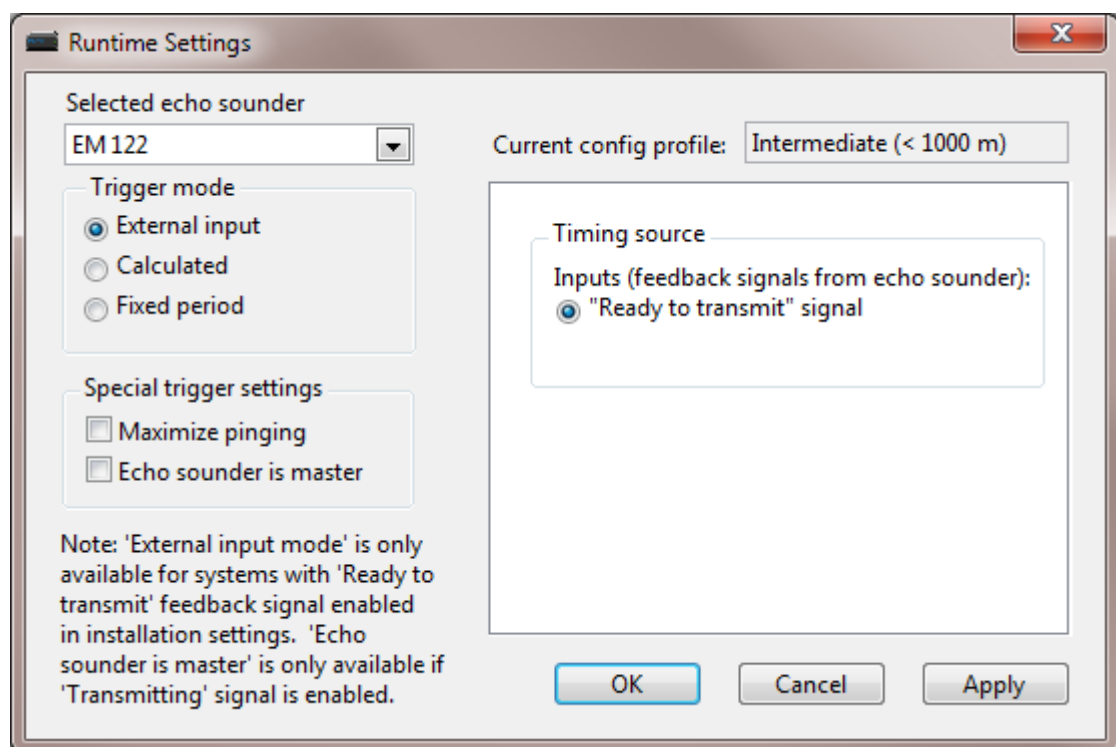


- 7 Optional step: If you are running the system for the first time, verify that the **Runtime Settings** are set correctly. The Runtime settings specify how the Synchronizing Unit will determine when each echo sounder is ready to advance to the next group (see figure *Runtime settings* on page 30).

An echo sounder that provides *ready to transmit* feedback signal should normally have the operating mode set to **External input**. Otherwise, check that the calculation parameters are set according to type of echo sounder.

If **Calculated** mode is selected, then the multiplication factor should be 0% if single beam echo sounder. This will cause the Synchronizing Unit to wait at least the duration of the two-way roundtrip time (travel time) at the current depth. A multibeam system will have a wider swath, and consequently the roundtrip time will increase depending upon swath angle. When **Calculated** is selected, the resulting duration for each parameter is computed and presented to operator to allow verification at current depth (see figure *Trigger Status* on page 29). If **Fixed period** mode is used, then enter the desired period. This period will be fixed regardless of depth.

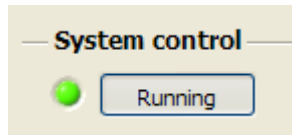
Figure 23 *Runtime settings*





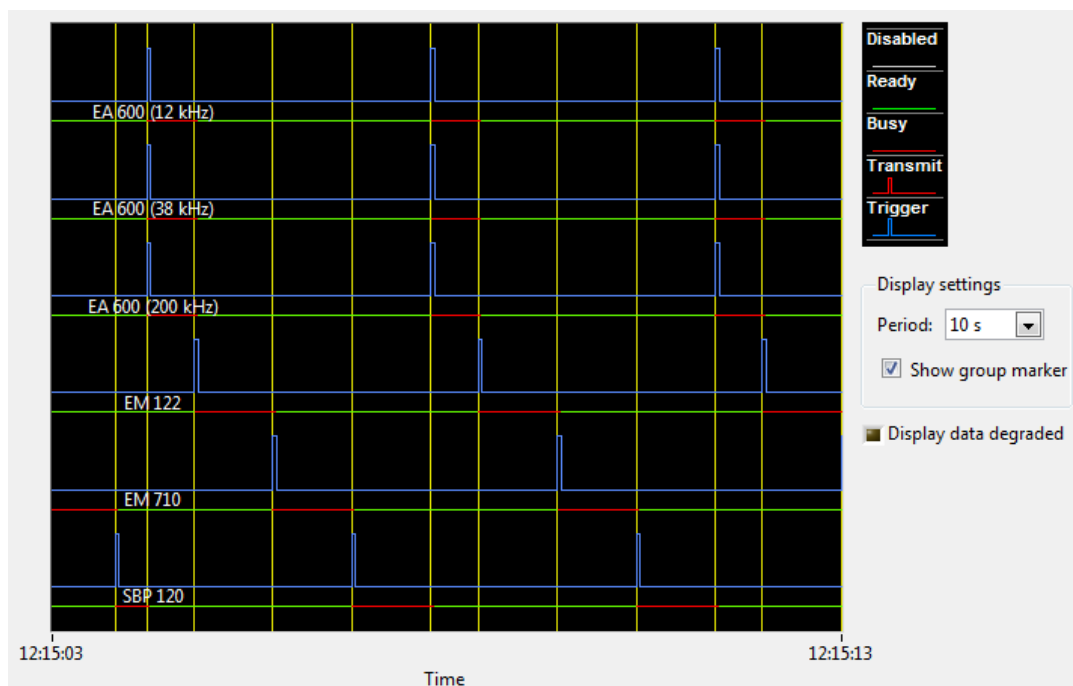
- 8 Synchronizing unit is enabled by clicking on the **Running/Paused** button next to it. When running, the LED will remain a steady green and button will indicate "running."

Figure 24 System control, running



- 9 When synchronization starts, the **Trigger display** shows the current state of triggering. It will indicate trigger by displaying a pulse on the blue trigger plot (see figure *Trigger display* on page 31). The groups are separated by yellow group markers (vertical line). Two lines are shown for each echo sounder: blue plot displays the trigger pulses as they are generated; the colored plot (red/green/gray) indicates the state and the events of the echo sounder. See the legend for description in figure *Trigger display* on page 38. Note that the plot will always show a red pulse whenever a transmit occurred (when not externally triggered, but free running).

Figure 25 Trigger display



- 10 The period of the trigger display can be set to 10, 30, or 60 seconds. The horizontal axis shows the current time.
- 11 The **active period** in the echo sounder status indicates how long the ping cycle of an echo sounder is (duration from trigger until echo sounder is ready again). Multibeam systems will typically have the longest active period while single beam system will have shortest active period (active period is the value to the right in Figure *Echo sounder status for one particular echo sounder* on page 29 ).

Read the chapter *OPERATIONAL PROCEDURES* on page 33 to learn more about configuring the K-Sync in more detail.

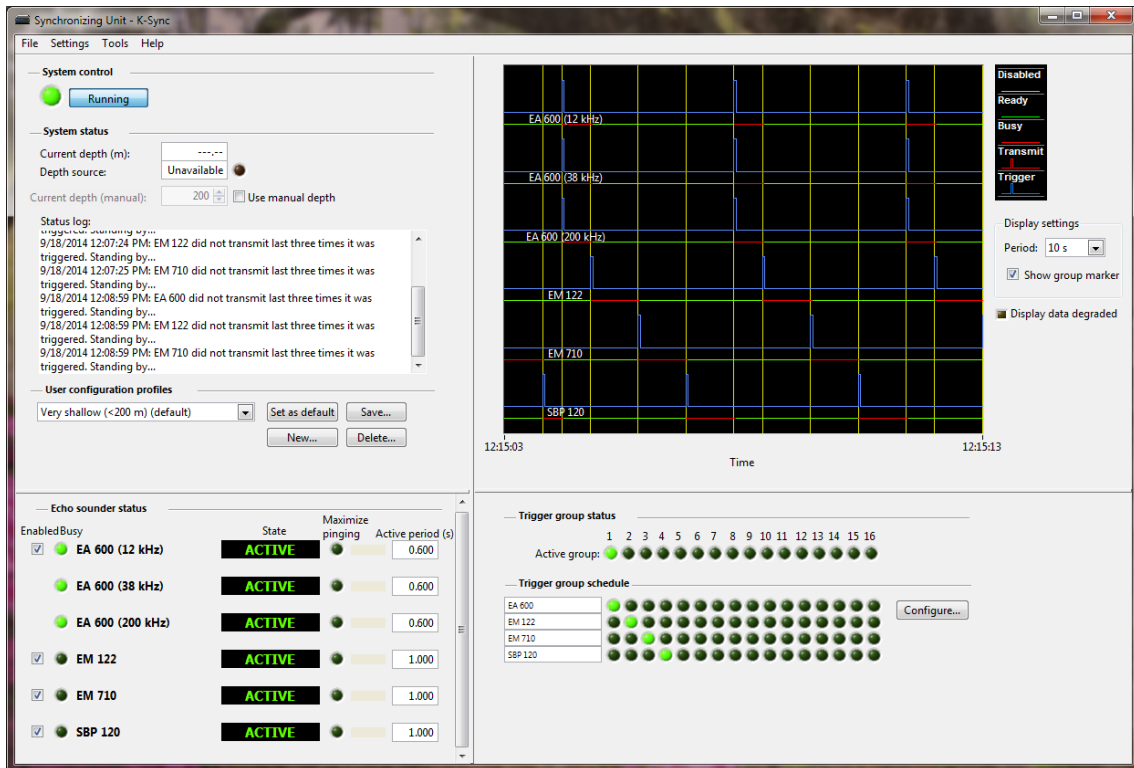
# OPERATIONAL PROCEDURES

## Overview

This chapter covers the topics applicable to normal operation of the Synchronizing Unit using the K-Sync Application on the Workstation. Specifically, how to control timing of synchronization, setting up trigger groups, utilizing user configuration profiles and interpreting the trigger display. The runtime settings will also be explained in detail.

The K-Sync Application serves to set up the Synchronizing Unit for proper operation, but the Synchronizing Unit is self-contained when it comes to performing the synchronization. Figure *K-Sync application user interface*, on page 34, provides a screenshot of the user interface. Each set of controls will be covered in the following sections.

Figure 26 K-Sync application user interface.



## System control

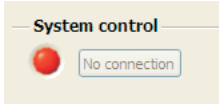
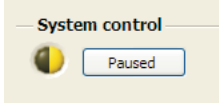
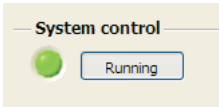
The system control area includes a status LED and a toggle button to control the operational state. It also provides status of the connection between the K-Sync Application and the Synchronizing Unit. When connected, it shows the state of the Synchronizing Unit, whether synchronization is paused or running. The operator can pause and start the synchronization by clicking the toggle button.

### Caution

*Always power up Synchronizing Unit before other echo sounders are turned on to avoid accidental pinging. Trigger outputs are undefined during power-up (first 20 seconds) of Synchronizing Unit and signal levels could potentially be interpreted as trigger pulse by the echo sounders until signal levels have settled.*

Once the K-Sync Application has been started, it will automatically attempt to connect to the Synchronizing Unit. The LED conveys the state of the Synchronizing Unit. This LED will remain red until connection has been established. See table *LED description* on page 35 for a description of the system

Table 2 LED description

System control	System state	Description of state
 <p>(LED is red)</p>	Not connected	K-Sync Application has not yet connected to the Synchronizing Unit. Status in the user interface is not updating and is grayed out.
 <p>(LED is yellow and blinking)</p>	Paused	Synchronization is paused (yellow LED is blinking). Trigger display updates current signal levels and echo sounder states, but no echo sounder is being triggered by Synchronizing Unit. Clicking button will enable running state.
 <p>(LED is green)</p>	Running	System is running and all enabled and scheduled echo sounders are being triggered. Clicking button will enable paused state.

The default state when the system is powered up and connected is paused mode. When paused, trigger display updates, but no synchronization takes place and no echo sounder is triggered. To start triggering click the toggle button and it will change to Running. No echo sounder will be triggered until they have been enabled and assigned to trigger groups. These settings will be explained later in this chapter.

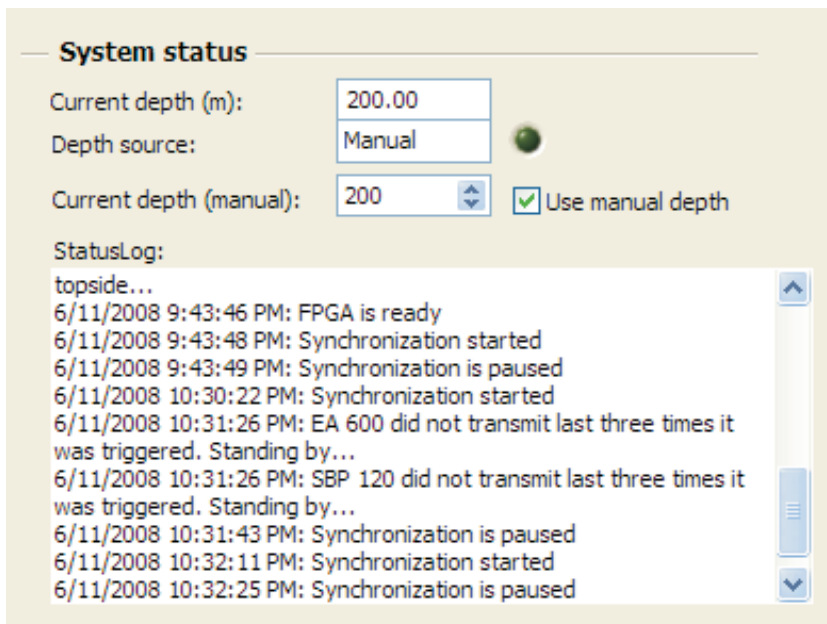
In the case the K-Sync Application loses the connection with the Synchronizing Unit, the LED will again turn red.

If the Workstation becomes disconnected (intentionally or if network connection fails), the Synchronizing Unit will continue to operate as before. The application will stop updating the status and the system control LED will turn red. When system reconnects, the K-Sync Application will return to the same state (running or paused) as before the system became disconnected and the current mode will be conveyed in the user interface.

## System status and manual depth setting

The system status provides information about incoming depth data and status/error messages from the Synchronizing Unit. Also, current depth can be overridden with a manual value, by enabling the Use manual depth checkbox as seen in figure *System status* on page 36.

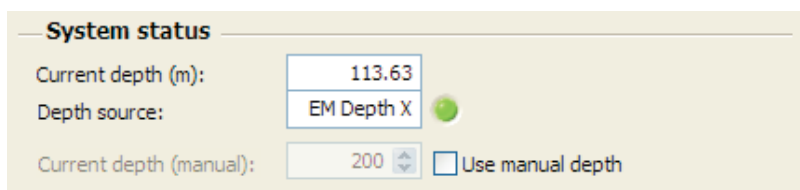
Figure 27 System status



The System status shows current depth and recent status and error messages from the Synchronizing Unit

The LED turns green when depth is received from an external source over network, (see figure *System status – current depth* on page 36). The controls for configuring external depth are contained in the System Settings (see section *Managing Installed Systems* on page 19).

Figure 28 System status – current depth



System status indicates that external depth is being received

## Trigger groups

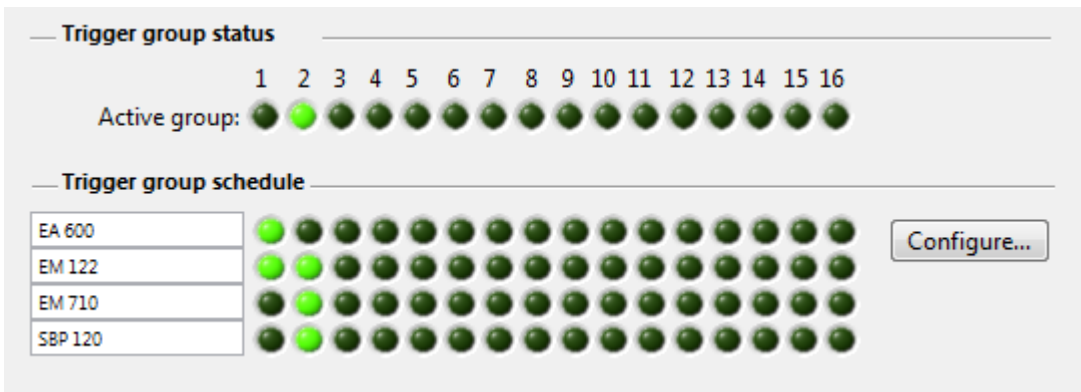
The trigger groups are the basis for scheduling of the echo sounders. They specify in what order and which echo sounders will transmit together. The specific timing of the individual echo sounders, on the other hand, is specified via the runtime parameters. All echo sounders in a group are triggered together; the next group is triggered once the first group has completed.

The display consists of two parts:

- 1 Active group indicator (see figure *Trigger group status* on page 37)
- 2 Trigger group schedule.

The active group indicator shows which group is currently active. Groups that do not have any echo sounders assigned or echo sounders that are not ready are skipped. A maximum of 16 groups can be scheduled. Since each echo sounder has different timing requirements, the duration of each group will depend upon which echo sounder has the longest active period.

Figure 29 *Trigger group status*

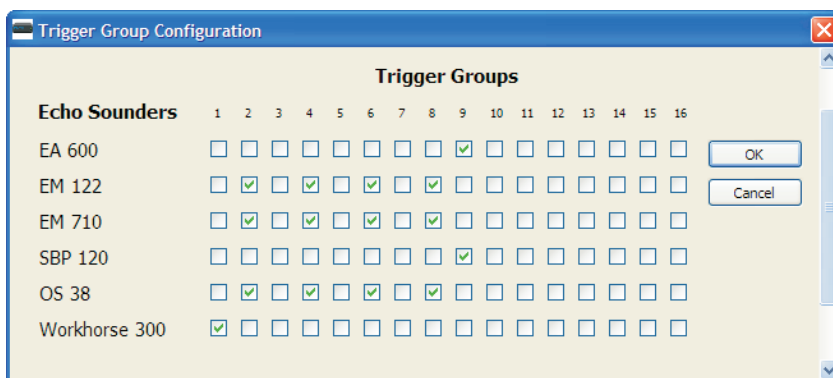


Trigger group status shows which is the current group and the trigger group schedule indicates which group each echo sounder is assigned to.

The trigger group schedule shows one system per row, and the trigger groups are grouped in columns. A green LED indicates that the echo sounder has been assigned to that group.

To modify the schedule, click the **Configure** button. The dialog shown in figure *Trigger groups – echo sounders* on page 37 will appear. Check the echo sounders to be assigned to the individual trigger groups.

Figure 30 *Trigger groups – echo sounders*



**Trigger group configuration** dialog allows user to assign echo sounders to trigger groups.

Echo sounders that will interfere with each other should be put into separate trigger groups. The goal is usually to trigger each echo sounder as frequently as possible to maximize data density. The type of survey will determine which echo sounders should be prioritized and scheduled to ping most frequently.

## Trigger display

The trigger display is a real-time display that shows the current state of each echo sounder plotted over time. There are two plots for each echo sounder: 1) trigger plot and the 2) state plot.

The *trigger plot* shows a pulse whenever the Synchronizing Unit is triggering the echo sounder. This plot is blue.

The *state plot* shows the current state based on scheduling and feedback signals and state is conveyed by its color (gray, green, red).

*Table 3 Interpretation of trigger display plots.*

Plot	State	Color/shape	Description
State plot	Disabled	Gray line	Echo sounder has been disabled by operator or the echo sounder is in standby state (i.e. timed out/not ready)
	Ready	Green line	Echo sounder is ready to be triggered
	Busy	Red line	Echo sounder is currently transmitting, receiving and/or processing samples (i.e. not ready)
	Transmit	Red pulse	Echo sounder acknowledged that a transmit occurred (width of pulse does not represent the duration of transmit pulse)
Trigger plot	Trigger	Blue pulse	Trigger pulse (width of pulse does not represent the duration of the trigger pulse)

### A few key points

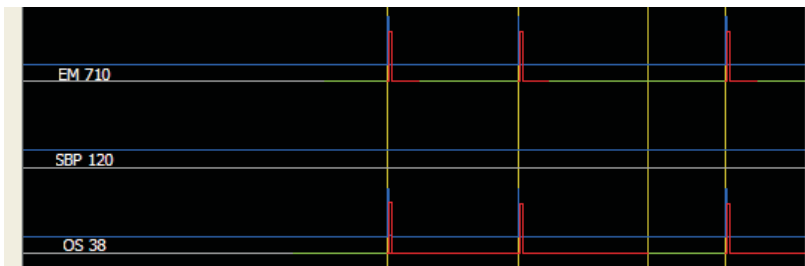
- If a transmit occurred (and if transmitting feedback signal is available), it will always be shown in the trigger display as a red pulse regardless whether the echo sounder is disabled, active, or standby.
- Echo sounders that do not provide a transmitting signal will not show any indication of transmit occurring in the plot.
- For high ping rates, the trigger display will not provide adequate resolution to show every pulse. The plot resolution is 50 ms, so the highest pulse rate that can be shown in detail is 10 Hz.



Each trigger group is visually separated by a yellow vertical group line.

By inspecting the trigger chart for a particular group it is possible to see which echo sounder is taking the longest to complete its ping cycle. This echo sounder will have a red line that starts at the beginning and extends all the way to the end of the group. This is illustrated in figure *Echo sounder – OS 38* on page 39.

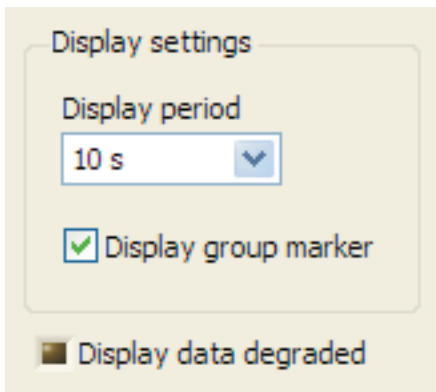
Figure 31 *Echo sounder – OS 38*



This plot shows an echo sounder, OS 38, which has the longest period in the group and consequently determines the maximum ping rate for the groups it is assigned to.

The duration along the horizontal axis can be set depending upon the typical ping rate. In deep water the display will be more readable if a longer duration is selected. The display period can be set to 5, 10, 30 or 60 seconds. The settings available are shown in figure *Display settings* on page 39.

Figure 32 *Display settings*



The trigger display settings allow the width of the display to be modified and the group marker to be enabled or disabled.

The group marker drawn between each trigger group can be turned off. There is also an indicator to notify when display data from Synchronizing Unit is not being received properly. The yellow indicator warns the operator that the trigger plots may not be accurate at the moment. This may happen if the CPU usage of Workstation is high.

An overview of how plots in the trigger display relates to the signal interface can be found in Appendix A.

## Echo Sounder status

The individual states of the echo sounders are shown in the Echo sounder status display. Also, a checkbox is provided for enabling and disabling each echo sounder.

Figure 33 Echo sounder status display

Enabled	Busy		State	Maximize pinging	Active period (s)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	EA 600 (12 kHz)	ACTIVE	<input type="checkbox"/>	0.868
<input type="checkbox"/>	<input type="checkbox"/>	EA 600 (38 kHz)	ACTIVE	<input type="checkbox"/>	0.868
<input type="checkbox"/>	<input type="checkbox"/>	EA 600 (200 kHz)	ACTIVE	<input type="checkbox"/>	0.868
<input checked="" type="checkbox"/>	<input type="checkbox"/>	EM 122	ACTIVE	<input type="checkbox"/>	1.268
<input checked="" type="checkbox"/>	<input type="checkbox"/>	EM 710	ACTIVE	<input type="checkbox"/>	1.268
<input checked="" type="checkbox"/>	<input type="checkbox"/>	SBP 120	ACTIVE	<input type="checkbox"/>	1.000

The Echo sounder status provides synchronizing status for each of the installed echo sounders




### Enable/disable echo sounder

The enable/disable checkbox that is associated with each echo sounder provides separate control of pinging. If enabled it will be triggered according to the schedule (see figure *Trigger groups – echo sounders* on page 37) if disabled it will not be triggered at all. This setting is located on the left hand side of the echo sounder status area of the user interface (see figure *Echo sounder status display* on page 40)

There are several indicators shown along with each echo sounder in this display:

- The green Busy LED is on when the echo sounder is being triggered or is in a busy state (transmitting and/or receiving, or processing samples).
- The scheduling state indicates whether the echo sounder is *disabled*, *standby* or *active*. See table *Scheduling state* on page 41 for a description of each state.

Table 4 Scheduling state

State	Description
	When state is disabled, the echo sounder has been disabled by operator and Synchronizing Unit will not trigger this echo sounder (i.e. enabled checkbox is unchecked).
	When state is standby, the echo sounder has timed out or is not ready. It will not be scheduled again until the condition that caused a timeout is no longer present (that is, ready to transmit signal becomes active again. Refer to Section 4.10 on Troubleshooting for more information).
	When state is active, the echo sounder can be scheduled and no known condition is preventing it from pinging next time it is triggered.

- The *maximize* LED and the master indicator convey if these settings are enabled for this echo sounder (see section *Runtime settings* on page 42 for more information).
- The *active* period displays the duration in seconds from time of trigger until echo sounder has completed its ping cycle. It shows the latest recorded value. The inverse of this value is the maximum theoretical ping rate if this echo sounder was triggered by itself. If the echo sounder is set to calculated or fixed period trigger mode with no *Ready to transmit* or *Transmitting* signal available, then K-Sync has no way of knowing the actual state of the echo sounder. Hence the state of the echo sounder will remain active until disabled and the value will simply reflect the timing parameters in runtime settings.

**Important** \_\_\_\_\_

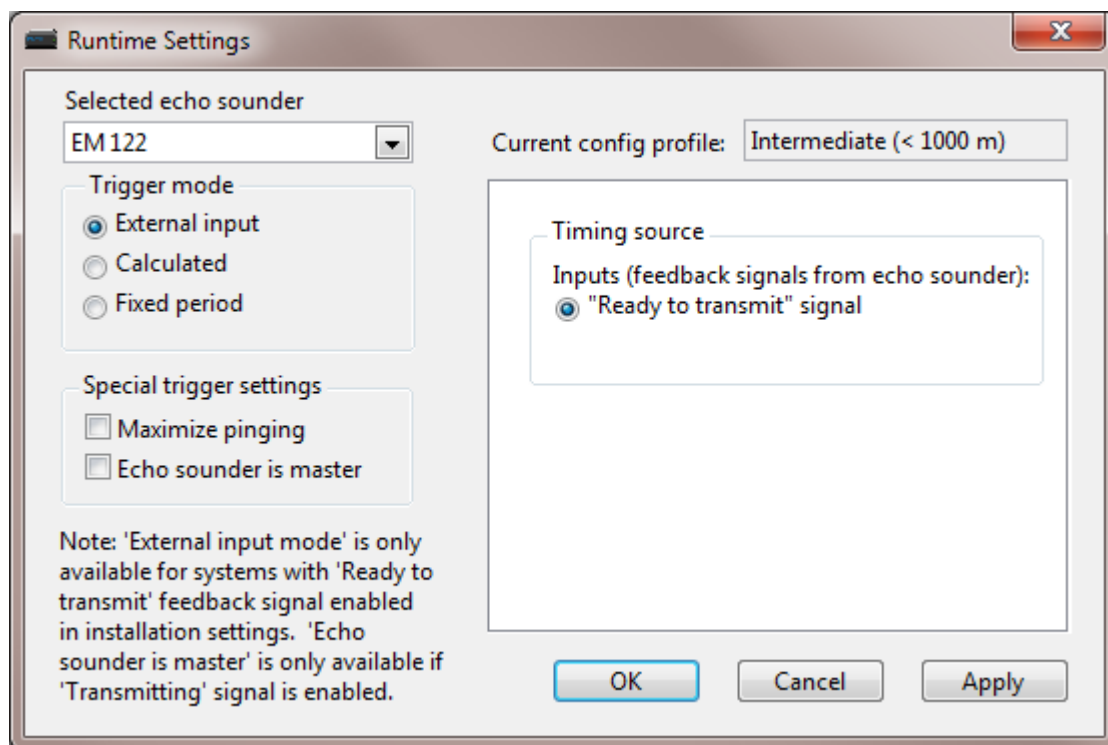
In the case that a system times out or fails to transmit three times in a row (echo sounder in standby state), it is possible to re-enable the system by unchecking and then rechecking the enabled checkbox.

## Runtime settings

Each echo sounder has its own set of configurable runtime settings. These settings establish how the Synchronizing Unit will determine when the echo sounder is ready to be triggered and when it can advance to the next group.

The runtime settings are available in the **Runtime Settings** dialog. To open the dialog, select from the application menu: **Settings** → **Runtime Settings...** The dialog shown in figure *Runtime settings dialog* on page 42 then appears.

Figure 34 *Runtime settings dialog*



In the upper left hand corner the echo sounder is selected. Just below, the trigger mode is specified. The trigger mode determines which method the Synchronizing Unit will use for timing the echo sounders (see section *Trigger Modes* on page 44). The special trigger settings are covered in section *Special trigger settings* on page 49. Some background information about timing is discussed in section *Determination of active period* on page 43.

### Note

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*The runtime settings are specific to each user configuration profile.*

---

## Determination of active period

One of the keys to optimal timing of the echo sounders lies in the estimation of the active period. The active period is defined as the duration the echo sounder is busy (transmitting, receiving, and processing) after a trigger. In other words: how long does it take before the echo sounder is ready to be triggered again? For scheduling to take place, the Synchronizing Unit needs to determine when an echo sounder has completed its ping cycle after being triggered. When all echo sounders have completed, the next group of echo sounders can be triggered.

The optimal situation is if each echo sounder provides a ready to transmit signal. When an echo sounder has completed its ping cycle, this signal will then become active. At this point the Synchronizing Unit knows it has completed and can trigger the next group of echo sounders. If this signal is not provided, the Synchronizing Unit will instead need to estimate the duration of the ping cycle.

The Synchronizing Unit can make a good estimate of active period by knowing some of the timing characteristics of the echo sounder. For most echo sounders the duration depends upon depth. For example, the duration may be the roundtrip time (two-way travel time) of the ping plus additional time needed for processing or to permit below sea floor data sampling.

The relationship between active period and depth can be modeled by the following formula:

$$t_{active\ period}(x_{depth}) = \frac{2x_{depth}}{v_{sound\ speed}}(1 + f_{multiplication\ factor}) + t_{fixed\ delay}$$

In this formula active period is estimated as a function of depth. The first term computes the two-way roundtrip time for a nadir sounding. The multiplication factor permits increasing this depth-dependent delay due to pointing angle off nadir. The last term adds additional time necessary for computation or for the echo sounder to become ready for next ping.

The parameters are obtained as follows:

*Table 5 Parameters for determination of active period*

Parameter	Source
X depth	Datagram from external source or alternately entered as a manual setting.
V sound speed	The sound speed is entered into the <b>System settings</b> dialog.
f multiplication factor	The multiplication factor is entered as a runtime setting in the Roundtrip calculation parameters area of the <b>Runtime settings</b> dialog.
t fixed delay	The fixed delay is entered in the <b>Runtime settings</b> dialog.

The runtime settings are discussed in more detail in section *Calculated mode* on page 46

The active period estimated by this formula can also be used to determine the maximum ping rate for the system at the specific depth. The maximum ping rate for this system will be the inverse of the active period calculated.

## Trigger Modes

The main runtime setting is trigger mode. The trigger mode establishes which method for determining or estimating the active period is used. Depending upon which trigger mode is selected, different parameters need to be provided.

*Table 6 Trigger Modes*

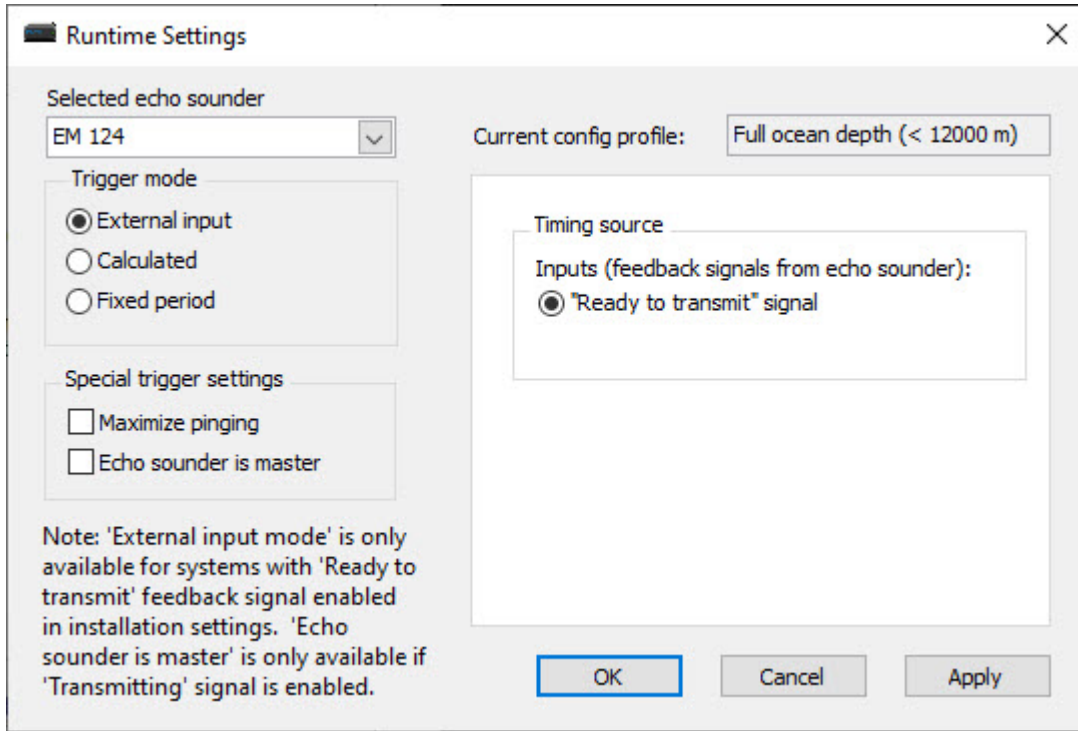
<b>Trigger mode</b>	<b>Active period determination method</b>
External input	The ready to transmit feedback signal is used to determine when echo sounder is ready to be triggered.
Calculated	The active period is estimated based on current depth (see formula is preceding section).
Fixed period	The active period is set to a fixed period.

When the echo sounder provides a ready to transmit signal and the trigger mode is set to External input, the Synchronizing Unit will depend solely on the feedback signal of the echo sounder to notify when its ping cycle is complete. If this signal is available the mode should be set to External Input.

If this signal is not provided, there are two alternate selections that allow the active period to be estimated. The most flexible option is to use the calculated trigger mode which estimates the active period based on current depth (see section *Calculated mode* on page 46). The simpler method is to use fixed period which is a fixed value, independent of depth (see section *Fixed period mode* on page 47).

**External input mode**

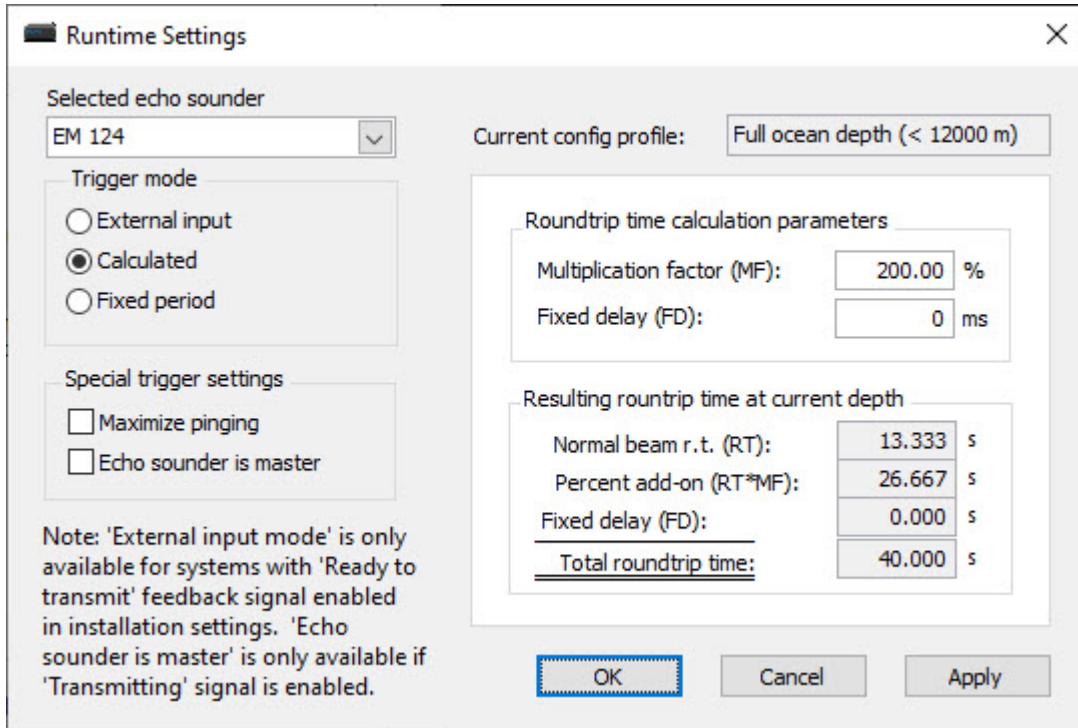
*Figure 35 Runtime settings dialog - External input*



Typically the trigger mode should be set to external input if the echo sounder provides a ready to transmit signal. The Ready to Transmit and the Transmitting feedback signals are configured as part of the installation settings. Only if the Ready to transmit signal is configured will the External input selection be available.

## Calculated mode

Figure 36 Runtime settings dialog - Calculated



The calculated mode is the most flexible mode when the active period needs to be estimated by the Synchronizing Unit. In this mode the ready to transmit signal is not used (if provided). It may require some fine-tuning to determine the optimal parameters. The multiplication factor compensates for the fact that increased travel time or range increases the active period. The second term adds a fixed delay regardless of depth.

The following two parameters are entered in the Roundtrip time calculation parameters area of the **Runtime Settings** dialog:

**Multiplication factor (%):** This value increases the period proportionally to depth (due to wide swath or pointing angle off nadir). The value can be set from 0 to 600 percent. Knowing the maximum pointing angle, Table *Basis for determining multiplication factor based on maximum angle of incidence* on page 47 can be used to arrive at an estimate. Multiplication factor provided in table is derived geometrically based on travel time for the beam with maximum pointing angle compared to nadir beam.



Table 7 Basis for determining multiplication factor based on maximum angle of incidence

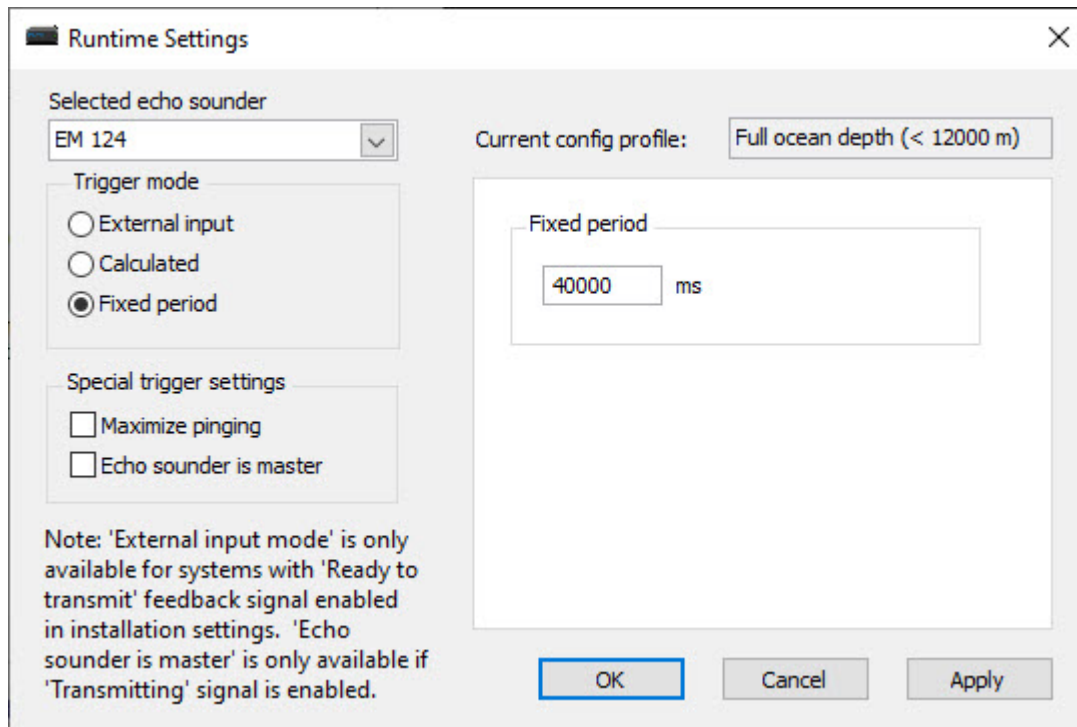
Maximum angle of incidence	Multiplication factor
0	0%
15	4%
30	15%
45	41%
60	100%
75	285%

**Fixed delay (ms):** Additional time that is independent upon depth (e.g. processing time). Range is 0 – 60,000 ms.

If both values are set to 0, then the active period will simply be the round trip time of a normal incidence sounding at current depth. Runtime parameters are unique for each profile, so it is possible to set up different parameters depending on the specific requirements of the survey.

**Fixed period mode**

Figure 37 Runtime settings dialog - Fixed period



When using fixed period trigger mode, only the period can be specified. Ready to transmit signal will be ignored for timing purposes (if provided). This setting is preferred when the active period does not vary directly based on current depth (may be particularly suitable for acoustic Doppler current profilers).

### Approach for determining best value for parameters

The goal of fine-tuning the timing of synchronization is to balance two tradeoffs when estimating the active period:

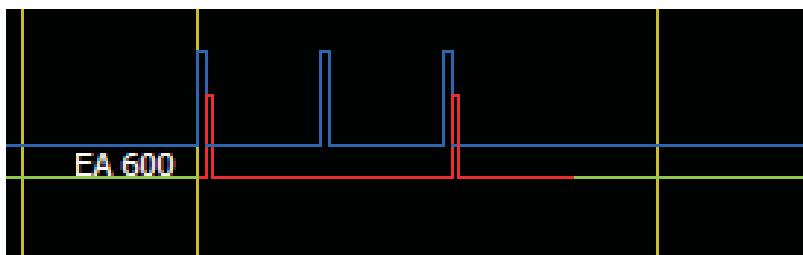
- Maximize data density: Keeping the estimated active period as short as possible.
- Minimize interference: Making sure that there is adequate delay between two consecutive pings. Also, if the same echo sounder is triggered in adjacent trigger groups, the period between triggers must be long enough to ensure echo sounder is ready when it is triggered (otherwise it will fail to ping).

When the active period is largely dependent upon the travel time of the ping and swath is known, table *Basis for determining multiplication factor based on maximum angle of incidence* on page 47 can be used as a starting point to arrive at an approximate value.

For an echo sounder that uses calculated or fixed delay trigger mode, a general method can be used to individually determine the timing parameters:

- 1 Assign first echo sounder (for which to estimate timing parameters) to one trigger group. Remove all other echo sounders from schedule or disable them.
- 2 Set the echo sounder to use calculated trigger mode if single beam or multibeam echo sounder; use fixed period otherwise.
- 3 If set to calculated, determine multiplication factor based on maximum pointing angle (use table *Basis for determining multiplication factor based on maximum angle of incidence* on page 47). This establishes the theoretical minimum active period based on maximum travel time.
- 4 Watch the trigger display or use other means for determining if a ping occurred after it was triggered by the Synchronizing Unit. The echo sounder will miss transmitting on some of the triggers if the period between triggers is too short (see figure *Trigger pulse* on page 48). If so, add additional fixed delay as needed so that echo sounder transmits on every trigger.
- 5 Continue with next echo sounder for which to estimate the timing parameters and do steps 2-5 again.

Figure 38 *Trigger pulse*



The active period is too short so the echo sounder does not ping on each trigger

This establishes the parameters applicable to individual pinging of echo sounders. Because of multi-paths of transmit, acoustic signal may linger in water much longer than the first return. The duration may therefore need to be extended further if such interference is impacting the data collected.

Once all echo sounders have been set up, it is recommended to add all echo sounders to one group and start with all echo sounders disabled. Then enable one additional echo sounder at a time. Try each out and see how the echo sounders impact each other by examining the data from the active echo sounders.

## Special trigger settings

The Synchronizing Unit has two settings which optimize the scheduling in specific circumstances.

**Maximize pinging:** Echo sounders have ping cycles of different duration and sometimes they can differ widely. Data density can be increased for echo sounders in a group by allowing echo sounders that have short ping cycles to ping multiple times while waiting for the slower ones to finish. If enabled, the echo sounder will be triggered repeatedly until the last echo sounder finishes in a group. An echo sounder will not be triggered again if it means the duration of the group would be extended.

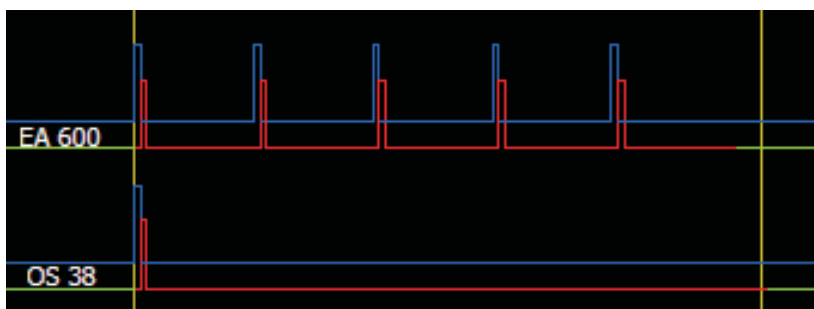
### Note

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*Maximize pinging mode is not suitable for echo sounders that have unpredictable active periods from one ping to the next. The maximize pinging feature assumes that the next ping cycle will take the same amount of time as the previous one.*

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Figure 39 Trigger display for EA 600 and OS 38



Trigger display showing EA 600 (top) configured to maximize pinging. The EA 600 is able to ping multiple times while the OS 38 (bottom) is performing a single ping.

**Echo sounder is master (pre-triggering):** In most cases, echo sounders transmit the instant they are triggered. With some echo sounders there is a significant ping latency (such as more than 50 ms). It is preferable that all echo sounders in the same group transmit as close as possible to minimize acoustic interference (especially if water column data is collected). The master setting allows the echo sounder with significant ping latency to be triggered first and once it starts transmitting, the other echo sounders in group are then triggered immediately. A requirement for this feature to work is that the echo sounder designated as master provides a transmitting signal that notifies when transmit occurred. Also, it is required that the master echo sounder transmits within 512 ms of trigger, otherwise it will still timeout.

Note that an echo sounder can be designated as Master independent of which Trigger mode is selected. Master can be set if the transmitting feedback signal is available and is configured in the installation settings.

#### Note

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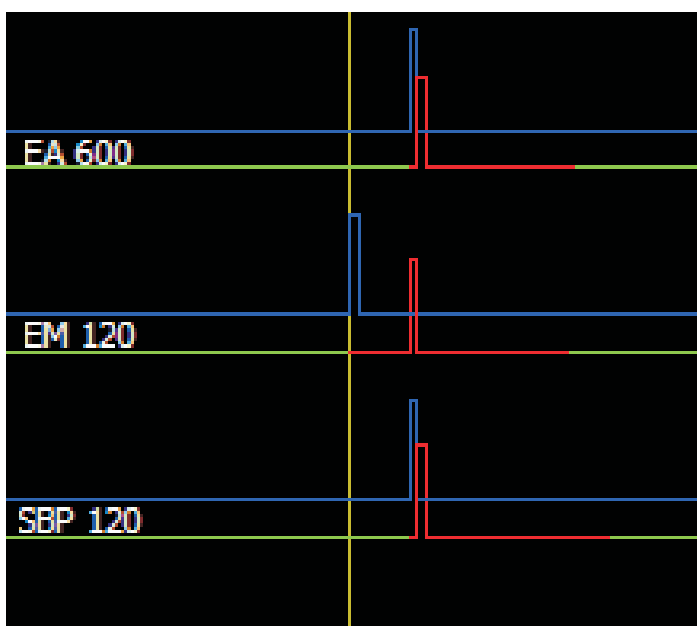
*The master setting is an advanced setting that only rarely is used (for example, EM 120 is the only KONGSBERG echo sounder that uses this setting). Also note that this setting does not designate the echo sounder as "master". The K-Sync is always considered the "master".*

---

To quickly verify if any echo sounder is configured as master, see the **Echo Sounder Status** area in the user interface. In figure *Diagnostic display* on page 52, the EM 120 is configured as master. As with all the runtime settings, they are independently configured for each user configuration profile.

In the figure *Trigger display for EA 600, EM 120 and SBP 120* on page 50 the EM 120 is set up as master and is triggered first (blue pulse). The other two echo sounders are triggered once the EM 120 has transmitted (red pulse).

*Figure 40 Trigger display for EA 600, EM 120 and SBP 120*



Trigger display showing EM 120 (middle) configured as master. The EA 600 (top) and the SBP 120 (bottom) do not get triggered until the EM 120 has transmitted.

#### Note

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*Maximize pinging will only be enabled for groups that does not have any echo sounders in them designated as master. This ensures that all echo sounders ping at the same time, but not while any echo sounder is receiving samples.*

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## User configuration profiles

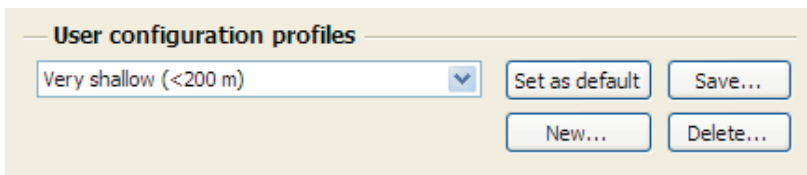
The operator can create configuration profiles to conveniently store multiple sets of settings. This provides ease and flexibility in configuring the Synchronizing Unit for each type of survey and also settings unique to various depth ranges.

The settings that are saved in a configuration profile are:

- Echo sounder enabled or disabled
- Trigger group schedule
- Runtime settings

When a configuration profile is selected (by clicking the drop-down list as seen in figure *User configuration profiles* on page 51) all the settings for each echo sounder are recalled and applied. If there are changes to current settings a confirmation dialog will first appear to confirm before recalling the settings in the configuration profile.

Figure 41 *User configuration profiles*



**User configuration profiles** allow saving and recalling runtime settings.

The following actions are supported when managing the configuration profiles:

Table 8

Select profile (from list)	Recalls settings from an existing profile
Set as default	Set the selected profile as the default
Save...	Save current settings to an existing profile (overwrite)
New...	Create a new profile (using current settings) with a specified name
Delete...	Delete an existing profile

The K-Sync Application comes with several pre-defined profiles.

Notes on configuration profiles:

- When settings are changed, they are not stored permanently until the operator explicitly saves settings to the profile.
- One user configuration profile is always designated as the “default” and this profile is used when the application starts up. The default profile has “(default)” appended after the profile name.
- The default profile cannot be deleted. If it needs to be deleted, a different profile must first be designated as the default.
- The system settings, installation settings, and manual depth setting (if enabled) are not stored in the profiles and are therefore not affected by switching between profiles.

- When new profiles are created, they are appended to the end of the list.

## Diagnostic tool

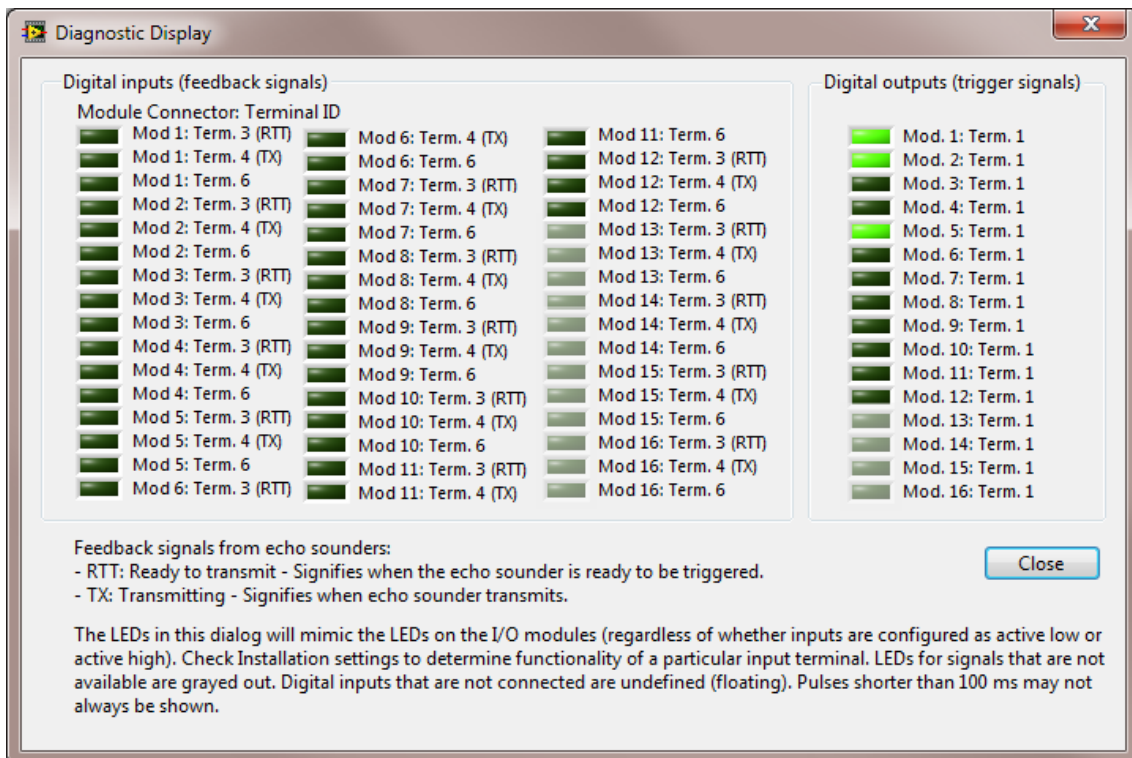
The **Diagnostic display** shows the signal level on each input and output of the Synchronizing Unit. There are up to 48 inputs (feedback signals) and up to 16 outputs (trigger signals) depending upon hardware configuration of SU.

In figure *Diagnostic display* on page 52, the dialog for the **Diagnostic display** is shown. The label next to each LED describes which module and terminal number it is associated with. The module and terminal number refer to the physical connections inside the Synchronizing Unit.

### Note

*The LEDs refer to the actual voltage level on the input (referred to as 5 V). If signal conditioning has been applied, the states may become inverted. For instance, if signal is set up for RS-232, the LED is on when voltage is -12 V; off when voltage is +12 V. If set up as TTL, then LED is on for +5 V and off for 0 V.*

Figure 42 Diagnostic display



The **Diagnostic Display** dialog shows the signal level of each digital input and output.

## Troubleshooting

This troubleshooting guide provides some solutions for solving common error conditions

Condition	Resolution
<p>K-Sync Application does not connect with Synchronizing Unit. LED in System Status is red/button: “No connection”</p>	<ol style="list-style-type: none"> <li><b>1</b> Check the configured IP address in the <b>System</b> dialog. Does it match the actual IP of the synchronizing unit? The default IP is 157.237.60.169.</li> <li><b>2</b> Is the network interface configured correctly? Default subnet is 255.255.240.0</li> <li><b>3</b> Try pinging the synchronizing unit from the command prompt.</li> <li><b>4</b> Does the network interface LEDs indicate that there is a physical link or activity?</li> <li><b>5</b> Cycle power of the Synchronizing Unit.</li> <li><b>6</b> Restart the Workstation.</li> <li><b>7</b> Any firewall or antivirus application blocking communication?</li> <li><b>8</b> Windows firewall passes through traffic to synchronizing unit?</li> <li><b>9</b> Try disabling all network interfaces and only configure the IP/subnet for the synchronizing unit.</li> </ol>
<p>Status log: “[Echo sounder] is no longer available (ready to transmit timed out). Standing by...”</p>	<ul style="list-style-type: none"> <li>• Make sure the echo sounder is set up for external trigger (check settings for the echo sounder itself).</li> <li>• Pinging is turned on.</li> <li>• If this happens during initial installation of system: The logic level for ready to transmit in the installation settings may have been set incorrectly. Or, it has been specified in installation settings that ready to transmit signal is available when it is not for this echo sounder.</li> </ul>
<p>Status log: “[Echo sounder] did not transmit last three times it was triggered. Standing by...”</p>	<p>Pinging or external trigger mode has been turned off for the system (check settings for the echo sounder itself).</p>

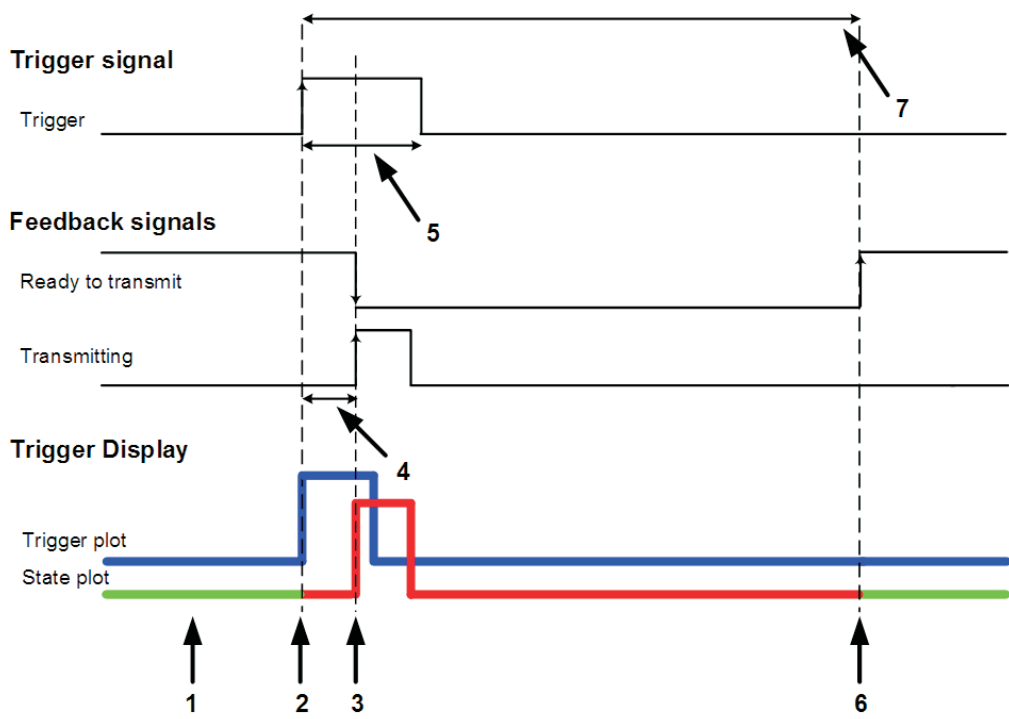
<b>Condition</b>	<b>Resolution</b>
The plot for a line is steady high (transmitting) instead of showing the states	The ping rate for the system is higher than the trigger display resolution (50 ms), display will not show individual pulses correctly unless ping rate is 10 Hz or below.
There is no red pulse indicating transmit in the trigger display for some of the echo sounders	Trigger pulse will only be shown if the echo sounder provides the <i>transmitting signal</i> and the signal is enabled in the installation settings.
Echo sounder state toggles between standby and active.	Check that the installation parameters for ready to transmit are correct (correct input terminal? Correct signal active level?)
Echo sounder goes to standby mode inadvertently and stops pinging when surveying in deep water.	Check that the ready to transmit timeout parameter in the installation settings for the echo sounder is long enough for the current survey depth.
Display data degraded LED frequently blinking.	<ul style="list-style-type: none"> <li>• High CPU usage? (&gt; 40%).</li> <li>• If network connection is shared, is there significant competing network utilization? (usage &gt; 10%).</li> </ul>



# Appendix A DESCRIPTION OF PING CYCLE

The following diagram explains the timing relationships of the trigger pulse, feedback signals and the trigger display plots.

Figure 43 Signals display



Note: Not drawn to scale

The timing relationships of the various signals and trigger display are shown. Signal transitions that are relevant to timing are indicated by an arrow.

This illustration assumes that both ready to transmit and the transmitting feedback signals are provided by the echo sounder. If ready to transmit is not available, then the period is estimated based on runtime settings provided. If *transmitting signal* is not available, it is not possible to know when transmit occurred. In the latter case, it also means that the trigger display (trigger plot) will not show a red pulse at time of transmit.

The following list explains each of the arrows in figure *Signals display* on page 55

- 1 Echo sounder is ready to be triggered (state plot is green). Ready to transmit signal is active.
- 2 Beginning of ping cycle. Synchronizing Unit triggers echo sounder (trigger signal becomes active). Trigger display shows a blue pulse.
- 3 Transmit occurs. The transmitting signal becomes active. Ready to transmit signal becomes inactive. Transmit has been verified, so the state plot in the trigger display shows a red pulse.
- 4 Transmit typically occurs immediately after the trigger pulse has been received by the Synchronizing Unit. The duration from trigger pulse until actual transmit is the ping latency.
- 5 Trigger pulse width. This property can be set in the installation settings.
- 6 Echo sounder has completed receiving samples and processing for this ping. The ready to transmit signal becomes high again. Echo sounder is now ready to be triggered. The trigger display shows the state plot in green color.
- 7 Active period is duration from trigger (2.) until echo sounder is ready to be triggered again (6.).

# Appendix B TECHNICAL SPECIFICATIONS

Some of the timing and signal specifications with respect to the Synchronizing Unit are listed below.

Trigger display resolution (horizontal):	50 ms
Trigger display width:	10, 30 or 60 seconds
Max. trigger groups:	16
Signal latency (feedback signal to trigger output):	40 $\mu$ s
Timing resolution of synchronization (calculated or fixed trigger mode):	4 ms
Available signal inputs:	12, 24, 36 or 48*
Max systems/trigger outputs:	4, 8, 12 or 16*
Supported signal levels (inputs and outputs):	TTL and RS-232
Supported depth datagram input:	<ul style="list-style-type: none"><li>• Kongsberg EM: D, X, and E</li><li>• Kongsberg EA 500</li><li>• NMEA: DPT and DBS</li></ul>

\* Depending upon delivered configuration (4, 8, 12 or 16 systems).

# Appendix C

## GLOSSARY

**Active (state):** State an echo sounder is in when it is capable of being scheduled and triggered.

See also: Disabled (state), Standby (state).

**Active period:** The period in which the echo sounder is transmitting, receiving and/or processing. The actual duration is defined as the time it takes for an echo sounder to become ready after having been triggered. The length of active period may depend upon current depth, swath and other factors.

**Calculated (trigger mode):** One of three trigger modes available for scheduling. The estimated active period is determined by depth and parameters provided by operator.

See also: External input (trigger mode), Fixed (trigger mode).

**Disabled (state):** State an echo sounder is in if operator set it to disabled (unchecked enabled checkbox).

See also: Active (state), Standby (state).

**External input (trigger mode):** One of three trigger modes available for scheduling. The estimated active period is equal the time between trigger and when ready to transmit becomes active.

See also: Calculated (trigger mode), Fixed (trigger mode).

**Fixed (trigger mode):** One of three trigger modes available for scheduling. The estimated active period is set equal to a fixed period.

See also: Calculated (trigger mode), External input (trigger mode).

**GPT:** General Purpose Transceiver. Refers to transceiver units for a product line of KONGSBERG single beam echo sounders (EK60, EA600 etc.).

**LED:** Light Emitting Diode. Used in this document to refer to an indicator in the user interface.

**Ping cycle:** The process of triggering, transmitting, receiving, data processing and becoming ready to transmit again.

**Ping latency:** The period it takes for an echo sounder to transmit once the trigger signal has been received.

**Ready to transmit (signal):** A feedback signal provided by an echo sounder in order to communicate when it is ready to receive the next external trigger.

See also: Transmitting (signal).

**RTS:** Ready to send. Name used by Kongsberg multibeam echo sounders to refer to the *Ready to transmit* signal.

**Standby (state):** State an echo sounder is in if it has timed out (either not ready or failed to transmit upon being triggered).

See also: Active (state), Disabled (state).

**Transmitting (signal):** Feedback signal provided by an echo sounder in order to determine if and when a transmit occurred.

See also: Ready to transmit (signal).

**WBT:** Wide Band Transceiver. Refers to transceiver units for a product line of newest KONGSBERG single beam echo sounders (EK80, EA640 etc.). WBTs are set up using **Configure GPTs** dialog box

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