8. Data Sampling

This chapter explains how to set and use Data Sampling.

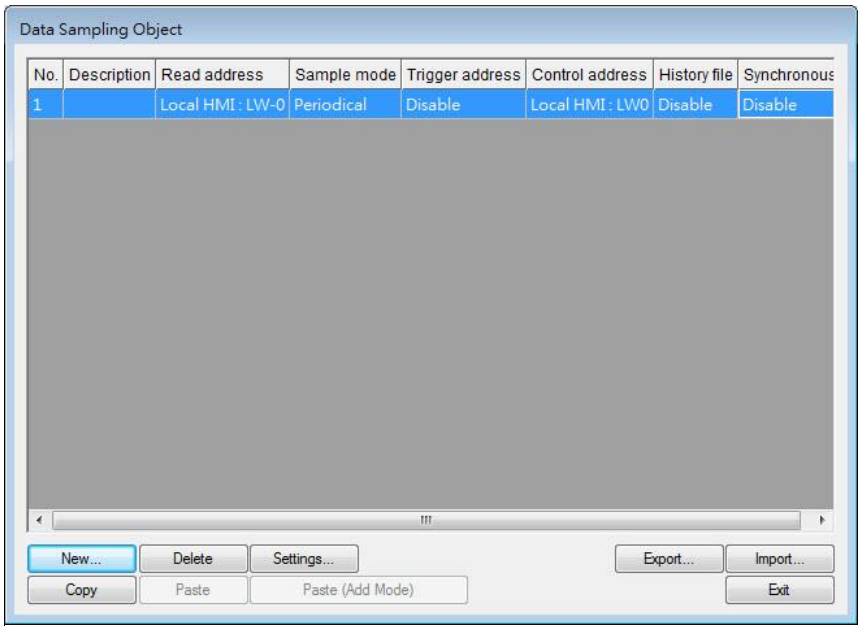
8.1. Overview

After defining how the data is sampled, by sampling time, address, or data length, the sampled data can be saved to the designated location, such as HMI memory, SD card, or USB disk. Trend Display and History Data Display objects can be used to display sampling records.

8.2. Data Sampling Management

Create a new Data Sampling object first by the following steps:

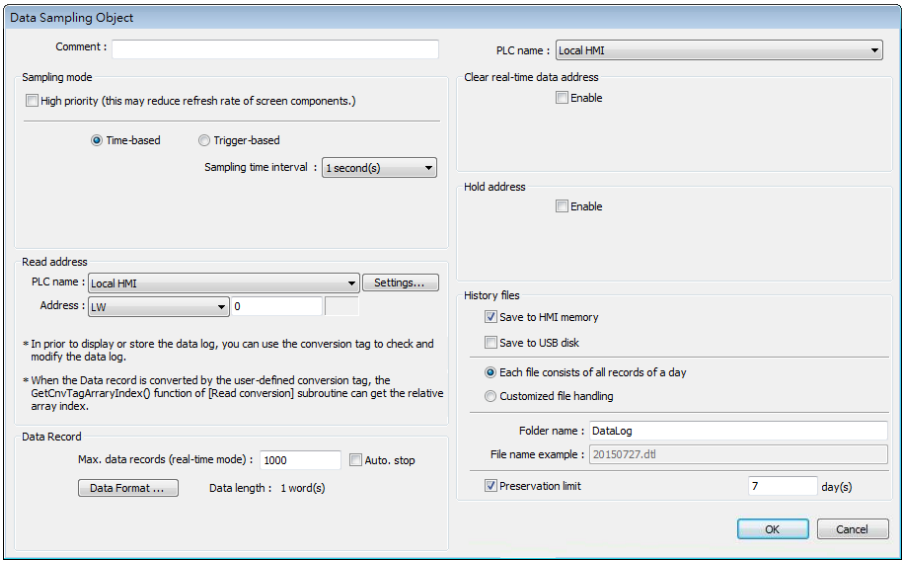
1. From the menu select [Data/History] and click [Data Sampling].
2. Click [New] to finish relevant settings.



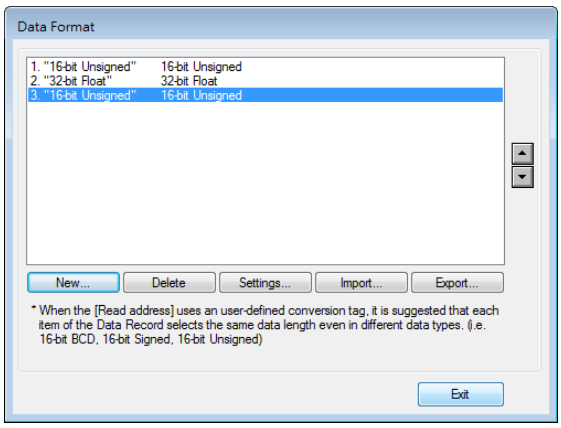
8.3. Creating a New Data Sampling

The following introduces how to set a new Data Sampling.

eMT, iE, XE, mTV, iP Series



Setting	Description
Sampling mode	**High priority** Data sampling processes with this feature enabled will be prioritized. Please note that too many priorities can slow down update rate of other objects. **Time-based** Samples data in a fixed frequency. The [Sampling time interval] can be set from “0.1 second(s) to 120 mins”. **Trigger-based** Triggers data sampling by the status of a designated bit address. **Mode** Conditions to trigger Data Sampling: [OFF -> ON] Triggers sampling when the status of the address changes from OFF to ON. [ON -> OFF] Triggers sampling when the status of the address changes from ON to OFF. [OFF <-> ON] Triggers sampling when the status of the address changes. **Set ON/OFF after triggered** If selected, after triggering Data Sampling, the system will set the designated bit address back to ON/OFF state.
Read address	Specify an address to be the source of Data Sampling. To convert a data record, please use a user-defined conversion tag that allows [Read conversion]. For array addresses, the GetCnvTagArrayIndex function can get the relative array index and then calculate.

Data Record (Real-time)	In Real-time Mode, when [Auto. stop] is not selected, the max. number of data records can be saved on HMI is 86400. When the number of records exceeds 86400, the earliest data will be deleted. **Data Format** Data of different formats in consecutive registers can be sampled. For example, setting: LW-0 (16-bit Unsigned), LW-1 (32-bit Float), and LW-3 (16-bit Unsigned). The upper limit for the number of records is 1000.  **Auto. stop** Data sampling will automatically stop when the number of records reaches [Max. data records]. See “8.3.1 Demonstration of Auto. stop”.
Clear real-time data address	Set when the bit address status changes from [OFF -> ON] or [ON -> OFF], clear the sampled data in Trend Display Real-time Mode. The number of data records returns zero but the data records that are already saved as history files will not be cleared.
Hold address	If the status of the designated address is set ON or OFF, sampling will be paused until the status of the designated address returns.
History files	**Save to HMI memory** Saves Data Sampling to HMI every 10 seconds. Or, use system register [LB-9034] to force storing data. See details on the restrictions of using LB-9034 in the Note below. **Save to SD card / USB disk** Saves Data Sampling to the specified external device. **Each file consists of all records of a day**

	The data sampling file will be saved on a daily basis into the specified folder, and the file name will be *yyyymmdd*.dtl, indicating the date of the file. **Folder name** Specify Data Sampling file name which must be all in ASCII characters. The folder name will be written as: [*Storage Location*] \ [*Folder Name*] \ [*File Name*] **Preservation limit** Determines the number of data sampling files to be preserved. Please note that the current .dtl file is not included in this limit. That is, if this limit is set to 2, apart from the current file, two latest files will be preserved.
Customized file handling	This feature can be used to customize naming and management of data sampling files (*dtl). See “8.3.2 Customized File Handling”.

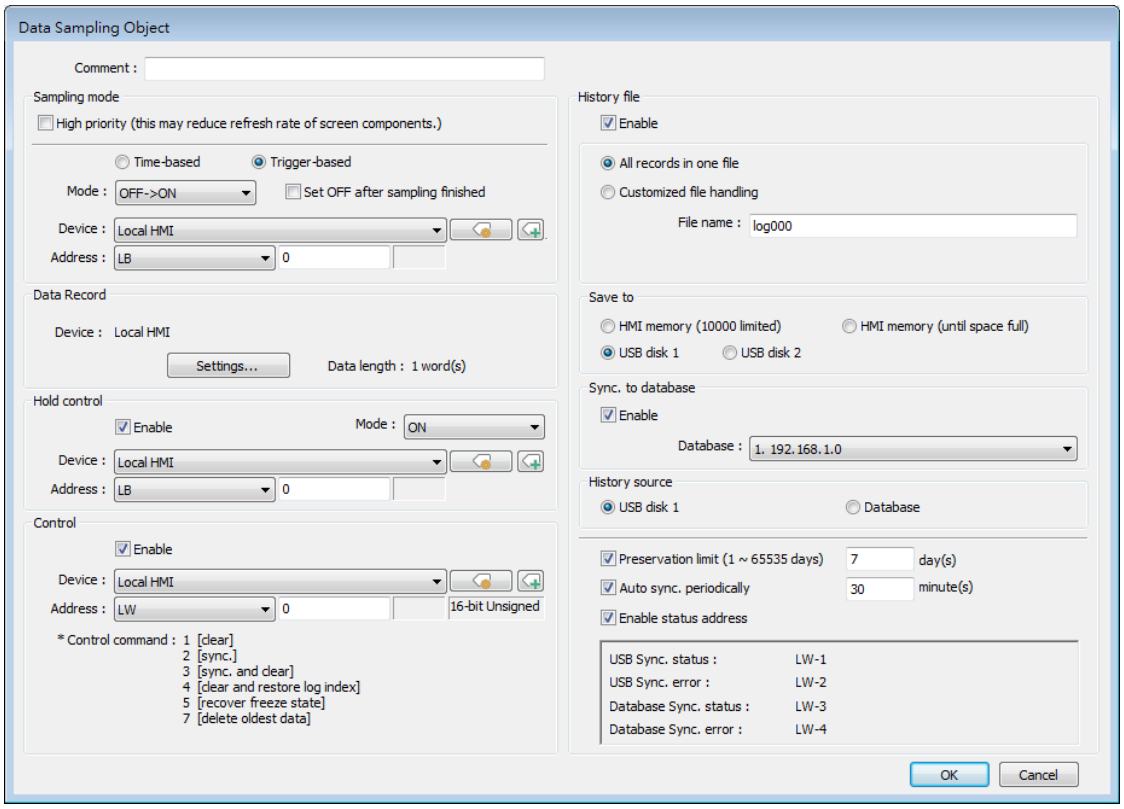
Note

- A Data Sampling may include more than one type of records. Data Sampling can retrieve different types of records at the same time. For example, if define three types of data, 4 words in total, the system retrieves a 4-word data each time from the designated address to be the content in one Data Sampling.
- When using [Each file consists of all records of a day] and set [Preservation limit] to 2 files, the data of yesterday and the day before yesterday will be kept. Data that is not built in this period will be deleted to prevent the storage space from running out.
- When using [Customized file handling] and set [Preservation limit] to 2 files, not only the currently sampled file, another 2 newest files (3 files in total) will be kept. The rest of the data will be deleted to prevent the storage space from running out.
- When running simulation on PC, all data sampling will be saved to the datalog folder in C:\EBPro\[*Storage Location*]\datalog. If you change the data format of data sampling, delete the previous data records in the installation directory to prevent the system from reading the old records.
- When saving files to USB disk or SD card, the capacity of a FAT32 folder depends on the length of the file names. Fewer files can be saved when the file names are longer.
- When using LB-9034, the shortest interval between two successful executions is 2 seconds. That is, after LB-9034 is triggered, it can be effective again 2 seconds later.

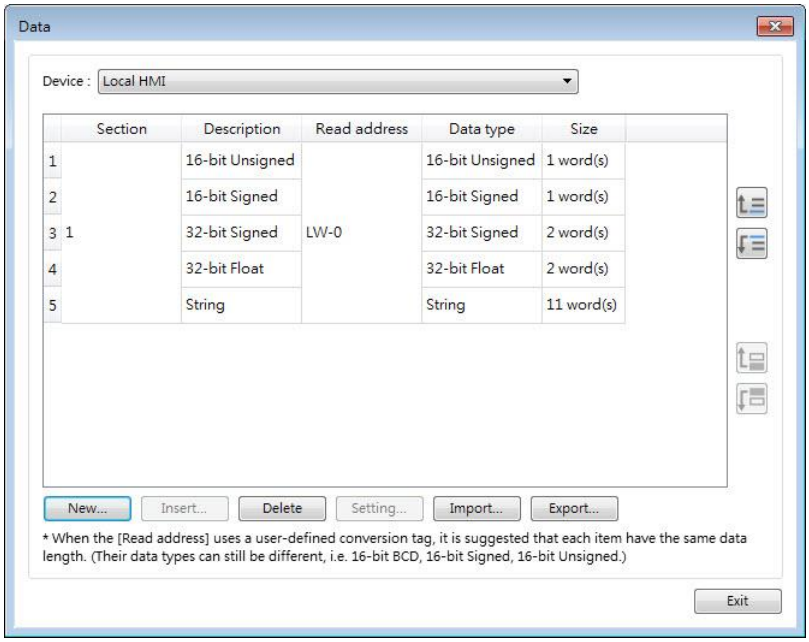
Click the icon to watch the demonstration film. Please confirm your internet connection before playing the film.

cMT, cMT X Series

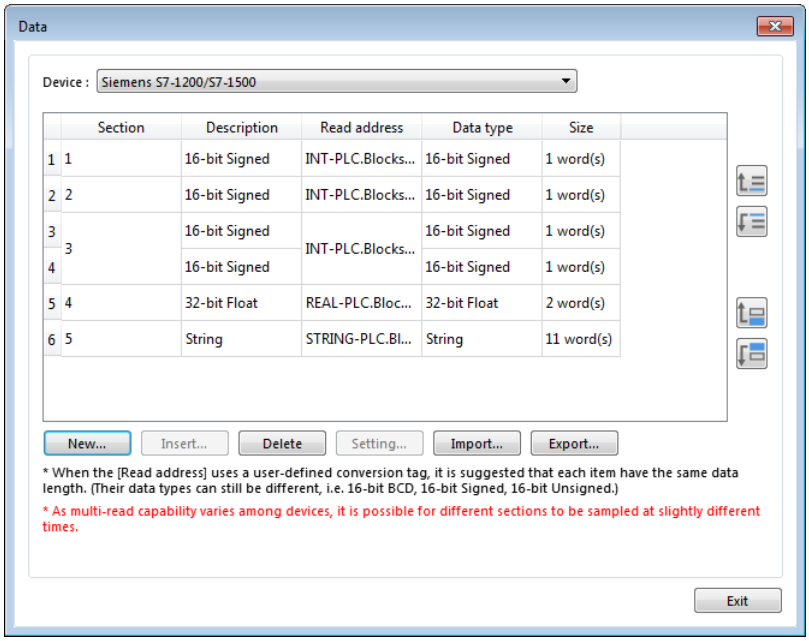
The settings are almost similar to eMT, iE, XE, mTV, iP Series. The following highlights the settings that are different.



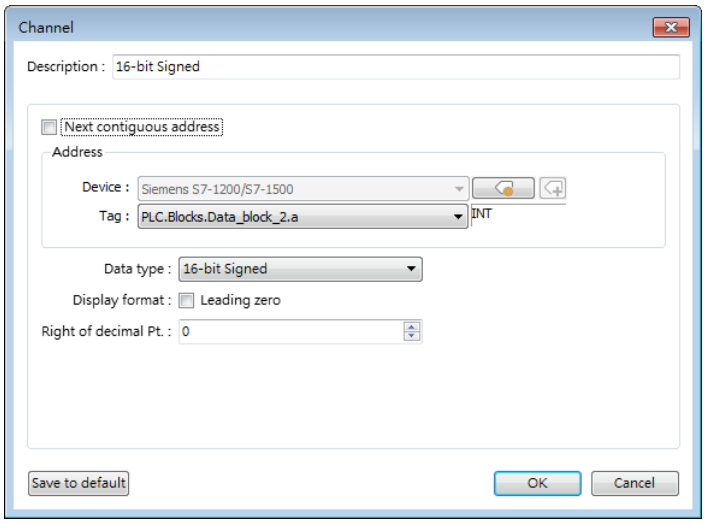
Setting	Description
Data Record	Data of different formats can be sampled. The upper limit for the number of records is 1000. Click the [Settings…] button to set the read addresses of different data types. For selected PLC drivers, sampling addresses of different sections is possible. For the drivers that can only sample contiguous addresses, simply set the data types. The display format settings may be used by Trend Displays and History Data Displays which are set to display the sampled data. **Next contiguous address** With this option selected when adding a new item, simply set the data type and it will be put into the same section as the previous read address. The following setting aims to read LW-0~LW-17 at a time.



When [Next contiguous address] option is **not** selected, multiple addresses can be read at a time.



Click [New] and de-select [Next contiguous address] option. The address setting shows, and a different address can be selected.



Please note that when contiguous address setting is used for a tag-based PLC driver, only one-dimensional arrays are supported.

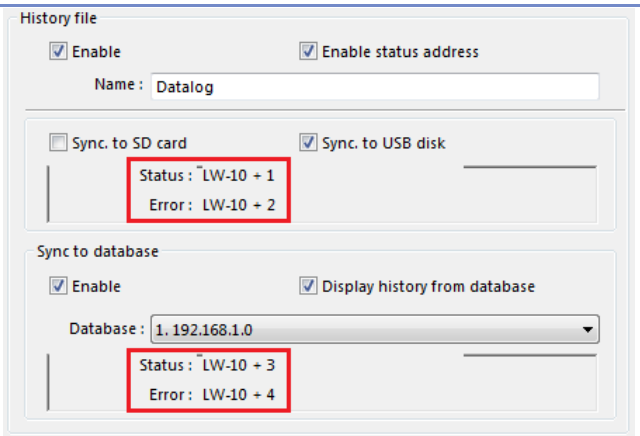
Control address

Entering a value in the control address sends the corresponding command.

Value	Command
1	Clear the sampled data in HMI.
2	Synchronize data to the external device / database.
3	Synchronize data to the external device / database and then clear the sampled data in HMI.
4	Use the history data stored in USB disk / SD card / database after changing HMI.
5	As data sampling stops when HMI storage is full, this command allows restarting of data sampling when there's free space.
6	Free up memory space reserved for data logs (*.db). This command can be used when historical data is saved to HMI memory (until space full).
7	Delete the oldest data (*.db).

Status & Error address

When LW-n is used as the control address, the four consecutive addresses following LW-n (LW-n+1~LW-n+4) will show status and error, please see the prompt in the settings dialog box.



Value	Status address: LW-n+1 and LW-n+3
0	Disconnected from external device or database
1	Connecting with external device or database
2	Connected with external device or database
3	Storing records into the archive. When this is done, the value returns to 2.
Value	Error address: LW-n+2 and LW-n+4
0	None
1	Unknown error
2	Failed to connect with external device or database
3	Access denied
4	Wrong database name
5	Inconsistent data format
6	Failed to open table
7	Failed to create table
8	Failed to write table
9	Failed to open database
10	Database is corrupted
11	The Row ID from the external device is inconsistent with the internal Row ID.

History files

History data can be saved to HMI memory (10000 limited or until space full), USB disk, SD card, and Database (by synchronizing history data to database server.).

The rules of saving the data are:

- When [Save to HMI memory (10000 limited)] is selected and the sampled data reaches 10000 records, the system will delete the earliest 1000 records and keep on saving data to HMI memory.

	• When [Save to HMI memory (until space full)] is selected, the system will keep on saving data to HMI memory, in this case, the data may not be synchronized to database server. When the HMI memory storage is full, the system will delete the earliest 1000 records and keep on saving data to HMI memory. • When USB disk or SD card is selected, and the number of records reaches 10000, the system will automatically save the sampled data to the external device and delete the earliest 1000 records on HMI. • To synchronize the data to database server, select a database that has been configured before.  See synchronization rules in "8.4 Synchronizing cMT Viewer data and Saving to External Device".  See Database Server usage in "13.44 Database Server".
Customized file handling	This feature can be used to customize naming and management of data sampling files (*db). The current *db file is saved in HMI memory. Please note the following two points when Sync. Destination is USB disk / SD card: 1. When *db file name changes, the *.db file with the former name will be synchronized to USB disk / SD card. 2. If a new *db file is generated when there's no existing USB disk / SD card on HMI, the earlier *db file will be deleted. For example, if 20161218.db is the current file, when 20161219.db is generated and no external device is inserted to HMI, and then 20161218.db will be deleted. When [Customized file handling] is used, enabling [Sync. to database] is not possible.  Find Customized File Handling settings dialog box in "8.3.2 Customized File Handling".
Auto sync. periodically	Data will be automatically synchronized to the designated external device in the specified time interval, regardless of the rules explained above. Please note that the timer will reset when a control address is used.  See "8.4 Synchronizing cMT Viewer data and Saving to External Device or Database Server".

All record in one file	When Sync. Destination is USB disk / SD card, the preservation limit is 1 to 65535 days.
Customized file handling	When Sync. Destination is USB disk / SD card, the preservation limit is 1 to 65535 files. When Sync. Destination is HMI memory, the preservation limit is 1 to 1000 files.
History source	Data can be read from USB disk, SD card, or Database.

8.3.1. Demonstration of Auto. stop

This feature depends on the arrangement of different objects and modes. (Set [Max. data records] to n.)

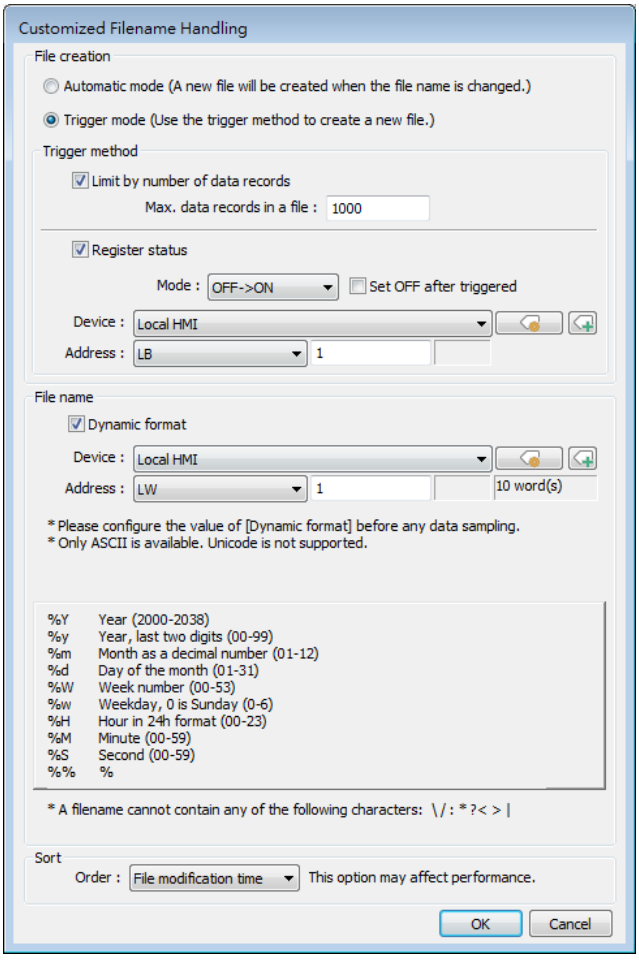
Object	[Auto. stop] not selected	[Auto. stop] selected
Trend Display- Real time	Deletes the earlier records and displays the latest number of records (n) in Trend Display. See the following figure.	Stops after reaching the specified number of data records (n).
Trend Display- Historical	Keeps on sampling data and displays all history data in Trend Display.	Stops after reaching the specified number of data records (n).
History Data Display	Keeps on sampling data and displays all history data in History Data Display.	Stops after reaching the specified number of data records (n).
Data Sampling	Keeps on sampling new data.	Stops after reaching the specified number of data records (n).

The figure illustrates how the data is sampled in Trend Display – Real Time mode when [Auto. stop check] box is not selected. Set the number of data records to 10, when the 11th data is generated, the earliest record is deleted and the newest record is added.

Record Number	Data	Not selecting [Auto. stop]
1	101	102
2	102	103
3	103	104
4	104	105
5	105	106
6	106	107
7	107	108
8	108	109
9	109	110
10	110	111
11	111	

8.3.2. Customized File Handling

This feature can be used to customize naming and management of data sampling files (*.dtl, *db).



Setting	Description
File creation	**Automatic mode** A new file will be created when the name of an existing file is changed. **Trigger mode** A new file will be created according to the [Trigger method] settings.
Trigger method	**Limit by number of data records** A new file will be created when the number of data sampling records reaches the specified "Max. data records in a file" **Register status** A new file will be created when the status of a designated bit address meets the specified condition. The condition is specified in Mode field. **Set ON/OFF after triggered** If selected, after the new file is created, the system will set the designated bit address back to ON/OFF state. **Following HMI reboot, generate and write to a new file only after trigger condition has been met.** When the trigger condition has *not* been met following HMI reboot and therefore no new file is generated, the new data will be written to the last file generated before HMI is rebooted. Downloading a new project to HMI is the same as rebooting HMI.
File name	The file name can be an alphanumeric name, and certain half-width symbols are allowed. The file name can also be specified by a file name syntax. **Dynamic format** The file names can be set by a designated word address, or by a file name syntax indicating the current system time. The file name syntax can be specified by selecting time buttons or entering the syntax in Format field. The length limit is from 1 to 25. The following half-width characters are not allowed: \ / : * ? " < > |
Sort	This setting affects how the system determines the sort order of historical files, which affects the file preservation

and backup logic.

File name

Files are sorted by their filenames in descending order.

File modification time

Files are sorted by the actual timestamps of the contents. (Because the system has to check the content of the files, this option may affect performance negatively.)

Example:

Consider the case where files have been generated in this order: filename_05--> filename_04--> filename_03--> filename_02--> filename_01. The earliest file is filename_05 and the latest file is filename_01.

With preservation limit set to 5 files, the two sorting methods yield different results when the 6th file is generated:

Sorted by Filename: filename_05 is seen as the latest file; therefore, filename_01 will be deleted.

Sorted by File Modification Time: filename_01 is seen as the latest file; therefore, filename_05 will be deleted.

Note on naming convention:

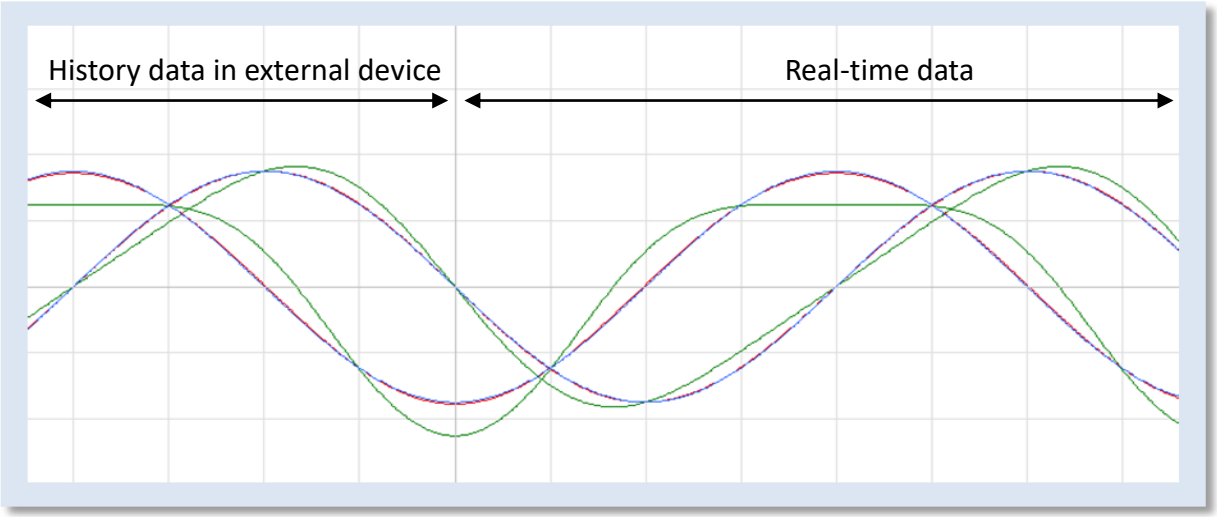
When File Name is selected as the sorting method and the filenames are: filename_1, filename_2, and filename_10, filename_2 will be seen as the latest file, followed by filename_10 and filename_1. To make filename_10 the latest file, please zero-pad the numbers and name the files to: filename_01, filename_02, and filename_10.

Note

- In Data Record settings, if the option [Next contiguous address] is not selected, the upper limit for the number of sections is 8.
- If both [Limit by number of data records] and [Dynamic format] check boxes are selected, before startup HMI, please enter the name in the designated register for Dynamic Format, otherwise, it is impossible the reach the “Max. data records in a file”, and the data sampling file will not be generated.
- When a new file is generated, the system will first detect if the filename already exists. If the file name does exist, the newly sampled data will be appended to the existing file.

Click the icon to download the demo project. Please confirm your internet connection before downloading the demo project.

8.4. Synchronizing cMT Viewer data and Saving to External Device or Database



For other series, when displaying the sampled data in Trend Display object, it is necessary to select from Real-time mode or History mode and the two modes cannot simultaneously be displayed in one object.

cMT / cMT X Series allows displaying history data and at the same time updates real-time data in one Trend Display or History Data Display object. The data saved in the external device can be updated.

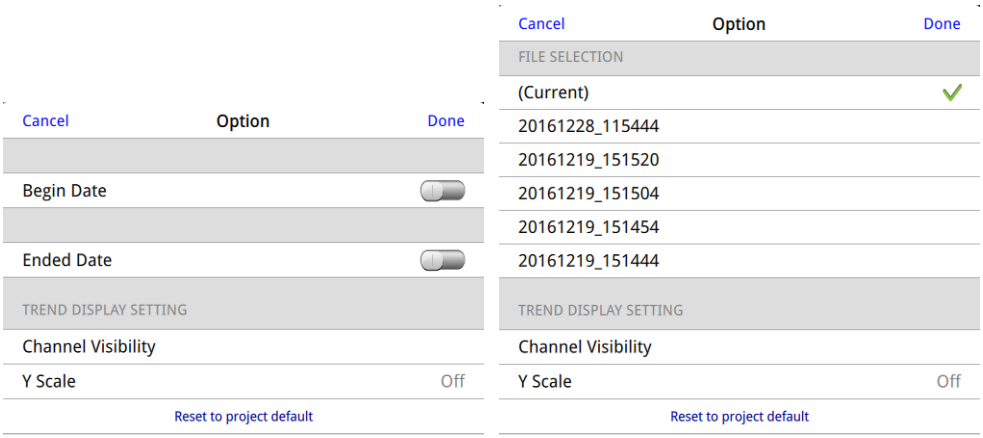
The rule of synchronizing the data saved in the external device:

1. When the sampled data reaches 10000 records, HMI will automatically save data to the external device and deletes the earliest 1000 records in HMI.
2. If the external device is removed from HMI and inserted back again at the time when the sampled data is under 9000 records, the data generated during the time the external device is removed is saved in HMI and is not cleared. If the data exceeds 9000 records during the time the external device is removed, the earlier data is cleared and cannot be synchronized even to insert the external device back to the HMI.
3. If there already exists sampled data in the external device, the new data is appended without overwriting the original data each time in synchronization.

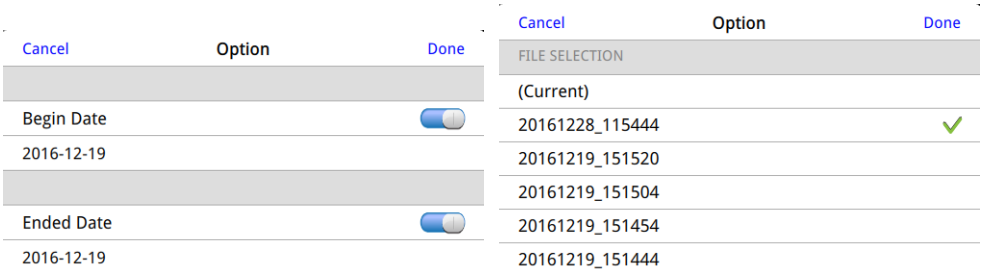
8.5. Checking History Data of a Specific Date / File on cMT Viewer.

To check the history data, see the following steps (Use Trend Display object as example).

1. Tap the  icon in the upper-right corner of the Trend Display object.
2. The following dialog box appears.



3. Specify the date or the file.



4. Tap [Done] button to finish setting.