

Communication with Omron controllers

7.1 Communication with Omron Hostlink/Multilink

7.1.1 Communication partner (Omron)

Introduction

This section describes communication between an HMI device and OMRON controllers of the SYSMAC C, SYSMAC CV, SYSMAC CS1, SYSMAC alpha, and CP series.

With these PLCs, the PLC's own protocol SYSMAC Way (Hostlink/Multilink protocol) is used for the connection.

Released communication types

The connection of an HMI device to an OMRON CPU of the OMRON SYSMAC C (not CQM-CPU11/21), SYSMAC CV, SYSMAC CS1, and SYSMAC alpha series using the Hostlink/Multilink protocol over RS232 has been system tested and released by Siemens AG.

A multipoint connection to up to 4 OMRON controllers in an RS422 four-wire multidrop configuration can be implemented with communications adapters.

Note

The HMI device can only be operated as a master.

7.1.2 Communication between HMI device and controller (Omron)

Communications principle

The HMI device and the PLC communicate using tags and the user data areas.

Tags

The PLC and the HMI device exchange data using process values. In your configuration, create tags that point to an address on the PLC. The HMI device reads and displays the value from the defined address. The operator can also make an entry on the HMI device that is then written to the address on the PLC.

User data areas

User data areas are intended for the exchange of special data and are set up only when such data is used.

Data for which user data areas are required, for example:

- Job mailboxes
- Transfer of data records
- Date/time synchronization
- Sign-of-life monitoring

The user data areas are created while configuring in WinCC flexible. You assign the corresponding addresses in the PLC.

7.2 Configuring the communication driver Omron Hostlink/Multilink

7.2.1 Requirements for communication (Omron)

Connector

The connection of the HMI device to an OMRON PLC is essentially restricted to the physical connection of the HMI device. No special blocks are required in the PLC for the connection.

Connect the HMI device to the Hostlink / Multilink port of the CPU (RS-232).

Cable

The following cables are available to connect the HMI device to an Omron PLC:

Port on the HMI device	Omron PLC			
	RS232, 9-pin	RS232 I/O periphery port	RS422, 9-pin	RS422, terminals/connector
RS232, 9-pin	PP1	Programming cable (standard Omron cable)	—	—
RS232, 15-pin	6XC1440-2X ...	—	—	—
RS232 over converter	—	—	—	Multipoint cable 1
RS422, 9-pin	—	—	PP2	Multipoint cable 2

... = length key (see catalog)

The HMI device port to be used is defined in the corresponding Manual.

7.2.2 Installing the communication driver

Driver for the HMI device

The driver for connection to OMRON controllers is supplied with WinCC flexible and is installed automatically.

No special blocks are required in the PLC for the connection.

7.2.3 Configuring the controller type and protocol (Omron)

Select the PLC

For a connection to an Omron PLC, double-click on "Communication ► Connections" in the project view of the HMI device. Go to the "Communication drivers" column and select the protocol Omron Hostlink / Multilink.

The property view displays the protocol parameters.

You can edit the parameters at any time by double-clicking "Communication ► Connections" in the project view of the HMI device. Select the connection and edit its parameters in the properties dialog box.

Note

The settings on the HMI device and on the PLC must match.

7.2.4 Configuring protocol parameters (Omron)

Parameters to be set

To edit the parameters, double-click "Communication > Connections" in the project window of the HMI device. In the project window of the HMI device, "Omron Hostlink / Multilink" is selected in the "Communication drivers" column. You can now enter or modify the protocol parameters in the Properties window:

Device-dependent parameters

- Interface

Select the HMI interface to which the OMRON PLC is connected under "Interface".

For more detailed information, refer to the Manual of the HMI device.

- Type

Here, you can only select "RS-232".

- Baud rate

Under "Baud rate" set the transmission rate between the HMI device and OMRON. Communication is possible at a baud rate of 19200, 9600, 4800, 2400 or 1200 baud.

Note

In multipoint projects, use baud rates of 9600 bauds and 19200 bauds. At lower baud rates, you may encounter breaks in communication.

Note

The highest station address must be less than or equal to 63 if you set a transmission rate of 1.5 Mbaud at OP 73 or OP 77A.

If connecting a TP 170A to a SIMATIC S7 station at a transmission rate of 1.5 MBaud on PROFIBUS DP, set a value less than or equal to 63 for the highest station address (HSA).

- Data bits

Select "7 bits" or "8 bits" under "Databits".

- Parity

Select "None", "Even" or "Odd" under "Parity".

- Stop bits

Select "1" or "2" "Stop bits".

PLC-dependent parameters

- Station address

Under "Station address" set the station number of the PLC.

7.2.5 Permitted data types (Omron)

Permitted data types

The table lists the user data types that can be used when configuring tags and area pointers.

Name	Range	Data type
Status	CPU status	BIN
Input/output words	I/O	BIN ¹⁾ , DEC, +/-DEC
Memory words	HR	BIN ¹⁾ , DEC, +/-DEC, LDC, +/-LDC, IEEE, ASCII
Auxiliary memory words	AR	BIN ¹⁾ , DEC, +/-DEC, LDC, +/-LDC, ASCII
Link memory words	LR	BIN ¹⁾ , DEC, +/-DEC, LDC, +/-LDC, ASCII
Data memory words	DM	BIN ¹⁾ , DEC, +/-DEC, LDC, +/-LDC, IEEE, ASCII
Timer/counter status	T/C BIN	BIN
Timer/counter actual values	T/C VAL	DEC, +/-DEC
PLC type	CPU type	BYTE

- ¹⁾ In the case of write accesses note:
With the "BIN" data type in the "I/O", "HR", "AR", "LR" and "DM" areas, after changing the specified bit the entire word is written back to the PLC. There is no check to determine whether any other bits in the word have changed. As a result, the PLC only has read access to the specified word.

Note

All data areas on the OMRON PLC can only be read or written reliably in the "STOP" or "MONITOR" modes.

"I/O" indicates either the IR/SR or the CIO area depending on the PLC series. The "LR", "HR", and "AR" areas are not available in all the PLC series.

Areas for newer PLCs

Areas for old PLCs	Areas CS and CJ PLCs
CPU status	CPU status
I/O	CIO
HR	H Range WinCC flex 0-511
AR	A
LR	n/a
DM	D
T/C	T/C
CPU type	CPU type

Special features of connections with Omron Hostlink/Multilink

Area pointers can only be created in "DM", "I/O", "HR", "AR" and "LR" areas.

As the Trigger tag for discrete alarms, only tags in the "DM", "I/O", "HR", "AR" and "LR" areas are permitted. These tags are only valid for the data types "DEC" and "+/-DEC".

Array tags may only be used for discrete alarms and trends. Only tags in the "DM", "I/O", "HR", "AR" and "LR" areas and only of the "DEC" and "+/-DEC" data types are permitted for array tags.

Addressing PLCs of the CV, CS and CJ series

With PLCs of the CV, CS and CJ series, timers 0-2047 are addressed with T/C 0-2047. Counters 0-2047 must be addressed in ProTool with an offset of 2048 (T/C 2048-4095 correspond to counters 0-2047).

Counters and timers with addresses higher than 2047 cannot be addressed over Hostlink.

Example:

If you want to address counter C20, the address in ProTool must be T/C 20+2048 = T/C 2068.

7.2.6 Optimizing the configuration

Acquisition cycle and update time

The acquisition cycles for the "Area pointers" and the those of the tags specified in the configuration software are decisive factors for the actual update times that can be achieved.

The update time is the sum of the acquisition cycle + transmission time + processing time.

To achieve optimum update times, remember the following points during configuration:

- Keep the individual data areas as small as possible and as large as necessary.
- Define data areas that belong together as belonging together. You can improve the update time by setting up one large data area instead of several small areas.
- If the acquisition cycles you select are too short, this is detrimental to the overall performance. Set the acquisition cycle to suit the rate of change of the process values. The rate of temperature changes at a furnace, for example, is significantly slower compared to the speed rate of an electrical drive. As a general guideline, the acquisition cycle should be approx. 1 second.
- Put the tags of an alarm or a screen in one data area without gaps.
- To allow changes in the PLC to be recognized reliably, they must be available at least during the actual acquisition cycle.
- Set the transmission rate to the highest possible value.

Discrete alarms

For discrete alarms, use arrays and assign the individual alarms to one bit of the array tags themselves and not to the individual subelements. For discrete alarms and arrays, only tags in the "DM", "I/O", "HR", "AR" and "LR" areas are permitted and only of the "DEC" and "+/-DEC" data types.

Screens

With screens, the update rate that can actually be achieved depends on the type and amount of data to be displayed.

During configuration, make sure that you only configure short acquisition cycles for objects that actually need to be updated quickly. This reduces the update times.

Trends

When using bit-triggered trends, if the group bit is set in the "Trend transfer area", the HMI device always updates all the trends whose bit is set in this area. It then resets the bits.

The group bit in the PLC program can only be set again after all bits have been reset by the HMI device.

Job mailboxes

The HMI device confirms acceptance of the job mailbox by entering the value zero in the first data word of the job mailbox. The HMI device now processes the job for which it requires time. If a new job mailbox is entered again immediately in the job mailbox, it may take some time before the HMI device can process the next job mailbox. The next job mailbox will only be accepted when there is computing capacity available.

7.3 User data areas

7.3.1 Trend request and trend transfer

Function

A trend is a graphic representation of one or more values from the PLC. The value is read out time- or bit-triggered depending on the configuration.

Time-triggered trends

The HMI device reads in the trend values cyclically at an interval specified in the configuration. Time-triggered trends are suitable for continuous processes, for example, the operating temperature of a motor.

Bit-triggered trends

By setting a trigger bit in the tag trend request, the HMI device either reads in a trend value or an entire trend buffer. Bit-triggered trends are used to represent fast changing values. One example might be the injection pressure in the production of plastic parts.

To trigger bit-triggered trends, create suitable external tags in the "Tags" editor of WinCC flexible. The tags must be linked with the trend areas. The HMI device and PLC then communicate with each other via these trend areas.

The following areas are available for trends:

- Trend request area
- Trend transfer area 1
- Trend transfer area 2 (only required with switch buffers)

Variables of the area "DM", "I/O", "HR", "AR" or "LR" are permitted. They must be of the data type "DEC", +/-DEC or an array tag of the data type "DEC", +/-DEC. During configuration you assign a bit to a trend. This sets a unique bit assignment for all areas.

Trend request area

The HMI device sets corresponding bits in the trend request area when you open a screen which contains one or several trends on the HMI device. When the screen is deselected, the HMI device resets the relevant bits in the trend request area.

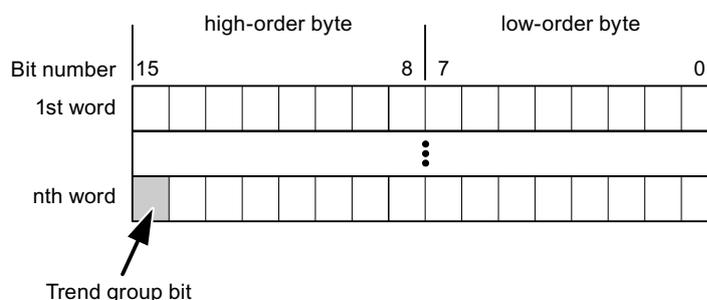
Using the trend request area, the PLC can recognize which trend is currently displayed on the HMI device. Trends can also be triggered without evaluation of the trend request area.

Trend transfer area 1

This area is used to trigger trends. In your PLC program, set the bit assigned to the trend in the trend transfer area and set the trend group bit. The trend group bit is the last bit in the trend transfer area.

The HMI device detects the trigger. The HMI device reads either a value or the entire buffer from the PLC. It then resets the trend bit and the trend group bit.

The following picture shows the structure of a trend transfer area.



The trend transfer area must not be changed by the PLC program until the trend group bit has been reset.

Trend transfer area 2

Trend transfer area 2 is required for trends configured with a switch buffer. The trend transfer areas 1 and 2 have a similar structure.

Switch buffers

The switch buffer is a second buffer for the same trend that can be set up during configuration.

While the HMI device reads the values from buffer 1, the PLC writes to buffer 2. If the HMI device is reading buffer 2, the PLC writes to buffer 1. This prevents the trend values being overwritten by the PLC while the trend is being read out by the HMI device.

7.3.2 LED mapping

Function

The function keys of the keyboard units of the Operator Panel (OP), Multi Panel (MP) and Panel PC are equipped with LEDs. These LEDs can be controlled by the PLC. This functionality can be used to activate an LED in order to tell the operator which key to press in a specific situation, for example.

Requirements

In order to enable control of an LED, you must set up an LED tag or array tag in the PLC and declare this as the LED tag in the configuration data.

LED assignment

Assign the LEDs to the LED tag bits when you configure the function keys. Define the "LED tag" and the corresponding "bit" for each function key in the "General" group of the properties view.

The bit number "bit" identifies the first of two consecutive bits that control the following LED states:

Bit n+ 1	Bit n	LED function	
		all Mobile Panels, Operator Panels, and Multi Panels	Panel PCs
0	0	Off	Off
0	1	Rapid flashing	Flashing
1	0	Slow flashing	Flashing
1	1	Permanent signal	Permanent signal

7.3.3 Area pointer

7.3.3.1 General information on area pointers (Omron Hostlink/Multilink)

Introduction

Area pointers are parameter fields. WinCC flexible Runtime reads these parameter fields in order to obtain information about the location and size of data areas in the PLC. The PLC and the HMI device interactively communicate read and write data for these data areas. The PLC and the HMI device trigger defined interactions based on the evaluation of stored data.

The area pointers reside in PLC memory. Their addresses are configured in the "Area pointers" dialog of the "Connections" editor.

Area pointers used in WinCC flexible:

- PLC job
- Project ID
- Screen number
- Data record
- Date/time
- Date/time PLC
- Coordination

Device-dependency

Availability of the area pointer depends on the HMI device used.

Application

Configure and enable the area pointer in "Communication ► Connections" before you put it into use.

Parameters		Area pointer					
For all connections							
Connection	Name	Address	Length	Trigger mode	Acquisition cycle	Comment	
<undefined>	Date/time PLC		6	Cyclic continuous	<undefined>		
<undefined>	Screen number		5	Cyclic continuous	<undefined>		
<undefined>	Project ID		1	Cyclic continuous	<undefined>		
For each connection							
Active	Name	Address	Length	Trigger mode	Acquisition cycle	Comment	
Off	Data mailbox		5	Cyclic continuous	<undefined>		
Off	Job mailbox		4	Cyclic continuous	<undefined>		
Off	Coordination		1	Cyclic continuous	<undefined>		
Off	Date/time		6	Cyclic continuous	<undefined>		

Enabling an area pointer based on the example of a SIMATIC S7 PLC

- **Active**
Enables the area pointer.
- **Name**
Name of the area pointer defined by WinCC flexible.
- **Address**
Tag address of the area pointer in the PLC.
- **Length**
WinCC flexible defines the default length of the area pointer.
- **Acquisition cycle**
Define an acquisition cycle in this field to allow cyclic reading of the area pointer in Runtime. An extremely short acquisition time may have a negative impact on HMI device performance.
- **Comment**
Save a comment, for example, to describe the purpose of the area pointer.

Accessing data areas

The table shows how the PLC and HMI device handle read (R) and write (W) access to the data areas.

Data area	Required for	HMI device	PLC
Screen number	Evaluation by the PLC in order to determine the active screen.	W	R
Data record	Transfer of data records with synchronization	R/W	R/W
Date/time	Transfer of the date and time from the HMI device to the PLC	W	R
Date/time PLC	Transfer of the date and time from the PLC to the HMI device	R	W
Coordination	Requesting the HMI device status in the control program	W	R
Project ID	Runtime checks consistency between the WinCC flexible project ID and the project in the PLC.	R	W
PLC job	Triggering of HMI device functions by the control program	R/W	R/W

The next sections describe the area pointers and their associated PLC jobs.

7.3.3.2 "Screen number" area pointer

Function

The HMI device saves information about the screen called on the HMI device to the "Screen number" area pointer.

This allows the transfer of the current screen contents from the HMI device to the PLC. The PLC can trigger specific reactions such as the call of a different screen.

Application

Configure and enable the area pointer in "Communication ► Connections" before you put it into use. You can create only **one** instance of the "Screen number" area pointer and only on **one** PLC.

The screen number is transferred spontaneously to the PLC. That is, it is always transferred when a new screen is activated on the HMI device. It is therefore unnecessary to configure an acquisition cycle.

Structure

The area pointer is a data area in the memory of the PLC with a fixed length of 5 words.

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1st word	Current screen type															
2nd word	Current screen number															
3rd word	Reserved															
4th word	Current field number															
5th word	Reserved															

- Current screen type
 - "1" for the root screen or
 - "4" for the permanent window
- Current screen number
 - 1 to 32767
- Current field number
 - 1 to 32767

7.3.3.3 "Date/time" area pointer

Function

This area pointer is used to transfer the date and time from the HMI device to the PLC.

The PLC writes control job "41" to the job mailbox.

When it evaluating the control job, the HMI device saves its current date and time to the data area configured in the "Date/time" area pointer. All definitions are coded in BCD format.

The "Date/Time" area pointer when used in a project which contains multiple connections must be enabled for each configured connection.

The date/time data area has the following structure:

Data word	Left byte								Right byte								
	15						8	7						0			
n+0	Reserved								Hour (0 to 23)								Time
n+1	Minute (0 to 59)								Second (0 to 59)								
n+2	Reserved								Reserved								
n+3	Reserved								Weekday (1 to 7, 1 = Sunday)								Date
n+4	Day (1 to 31)								Month (1 to 12)								
n+5	Year (80 to 99/0 to 29)								Reserved								

Note

The entry of values from 80 to 99 in the "Year" data area returns the years 1980 through 1999; values from 0 to 29 return the years 2000 through 2029.

7.3.3.4 "Date/time controller" area pointer

Function

This area pointer is used to transfer the date and time from the PLC to the HMI device. Use this area pointer if the PLC is the time master.

The PLC loads the data area of the area pointer. All definitions are coded in BCD format.

The HMI device reads the data cyclically within the configured acquisition cycle and synchronizes itself.

Note

Set an acquisition cycle of sufficient length for the date/time area pointer in order to avoid any negative impact on HMI device performance.

Recommended: Acquisition cycle of 1 minute if your process can handle it.

The date/time data area has the following structure:

DATE_AND_TIME format (in BCD code)

Data word	Left byte			Right byte		
	15	8	7	0
n+0	Year (80 to 99/0 to 29)			Month (1 to 12)		
n+1	Day (1 to 31)			Hour (0 to 23)		
n+2	Minute (0 to 59)			Second (0 to 59)		
n+3	Reserved			Reserved	Weekday (1 to 7, 1 = Sunday)	
n+4 ¹⁾	Reserved			Reserved		
n+5 ¹⁾	Reserved			Reserved		

- 1) The two data words must be available in the data area in order to ensure compliance of the data format with WinCC flexible and to avoid the reading of incorrect information.

Note

Note that when you enter the year, values 80-99 result in years 1980 through 1999 and the values 0-29 result in the years 2000 through 2029.

7.3.3.5 "Coordination" area pointer

Function

The "Coordination" area pointer is used to implement the following functionality:

- detection in the control program of HMI device startup
- detection in the control program of the current HMI device operating mode
- detection in the control program of the HMI devices ready to communicate state

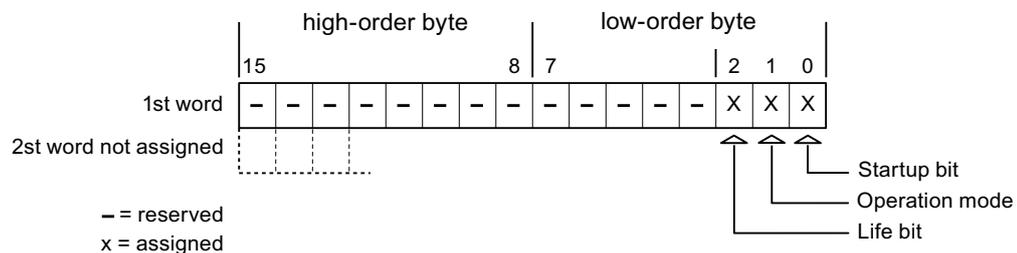
The "Coordination" area pointer has a length of two words.

Application

Note

The HMI device always writes the entire coordination area when updating the area pointer. The control program may not make changes to the coordination area for this reason.

Assignment of bits in the "Coordination" area pointer



Startup bit

The startup bit is set briefly to "0" by the HMI device during startup. It sets the bit permanently to "1" when startup is completed.

Operating mode

The operating mode bit is set to 1 as soon as the user switches the HMI device offline. The state of the operating mode bit is "0" during normal operation of the HMI device. You can determine the current operating mode of the HMI device by reading this bit.

Life bit

The HMI device inverts the life bit at intervals of approximately one second. You can check whether or not the connection to the HMI device is still up by querying this bit in the control program.

7.3.3.6 "Project ID" area pointer (Omron)

Function

You can check whether the HMI device is connected to the correct PLC at the start of runtime. This check is important when operating with several HMI devices.

The HMI device compares a value stored on the PLC with the value specified in configuration data. This ensures compatibility of configuration data with the control program. If discrepancy is detected, a system alarm is displayed on the HMI device and runtime is stopped.

Application

Settings in configuration data required when using this area pointer:

- Define the version of configuration data. Possible values between 1 and 255.
Enter the version in the "Device settings ► Device settings" editor in "Project ID."
- Data address of the value for the version that is stored in the PLC:
Enter the data address in the "Communication ► Connections" editor in "Address."

Connection failure

A connection failure to a device on which the "project ID" area pointer is configured results in all the other connections in the project being switched to "offline".

This behavior has the following prerequisites:

- You have several configured connections in a project.
- You are using the "project ID" area pointer in at least one connection.

Causes which may set connections "offline":

- The PLC is not available.
- The connection has been switched offline in the engineering system.

7.3.3.7 "Job mailbox" area pointer

Function

The PLC can use the job mailbox to transfer jobs to the HMI device to trigger corresponding actions on the HMI device. These functions include, for example:

- Display screen
- Set date and time

Data structure

The first word of the job mailbox contains the job number. Depending on the job mailbox, up to three parameters can be transferred.

Word	Left byte	Right byte
n+0	0	Job number
n+1	Parameter 1	
n+2	Parameter 2	
n+3	Parameter 3	

The HMI device evaluates the job mailbox if the first word of this job is unequal to zero. This means that the parameters must be entered in the job mailbox first, followed by the job number.

When the HMI device accepts the job mailbox, the first word is set to 0 again. The execution of the job mailbox is generally not completed at this point in time.

Job mailboxes

All job mailboxes and their parameters are listed below. The "No." column contains the job number of the job mailbox. Job mailboxes can only be triggered by the PLC when the HMI device is online.

Note

Please note that not all HMI devices support job mailboxes. TP 170A and Micro Panel do not support PLC jobs, for example.

No.	Function	
14	Setting the time (BCD coded)	
	Parameter 1	Left byte: - Right byte: hours (0-23)
	Parameter 2	Left byte: minutes (0-59) Right byte: seconds (0-59)
	Parameter 3	-
15	Setting the date (BCD coded)	
	Parameter 1	Left byte: - Right byte: weekday (1-7: Sunday-Saturday)
	Parameter 2	Left byte: day (1-31) Right byte: month (1-12)
	Parameter 3	Left byte: year
23	User logon	
	Logs the user on with the name "PLC user" at the HMI device with the group number transferred in Parameter 1. The logon is possible only when the transferred group number exists in the project.	
	Parameter 1	Group number 1 to 255

No	Function	
14	Setting the time (BCD coded)	
	Parameter 2, 3	-
24	User logoff	
	Logs off the current user. The function corresponds to the "logoff" system function)	
	Parameter 1, 2, 3	-
40	Transfer date/time to PLC	
	(in the S7 format DATE_AND_TIME) An interval of at least 5 seconds must be maintained between two successive jobs to prevent overload of the HMI device.	
	Parameter 1, 2, 3	-
41	Transfer date/time to PLC	
	(In OP/MP format) An interval of at least 5 seconds must be maintained between successive jobs in order to prevent overload of the HMI device.	
	Parameter 1, 2, 3	-
46	Update tags	
	Causes the HMI device to read the current value of the PLC tags whose update ID matches the value transferred in Parameter 1. (Function corresponds to the "UpdateTag" system function.)	
	Parameter 1	1 - 100
49	Clear process alarm buffer	
	Parameter 1, 2, 3	-
50	Clear alarm buffer	
	Parameter 1, 2, 3	-
51	Screen selection ¹⁾	
	Parameter 1	Screen number
	Parameter 2	-
	Parameter 3	Field number
69	Read data record from PLC	
	Parameter 1	Recipe number (1-999)
	Parameter 2	Data record number (1-65535)
	Parameter 3	0: Do not overwrite existing data record 1: Overwrite existing data record
70	Write data record to PLC	
	Parameter 1	Recipe number (1-999)
	Parameter 2	Data record number (1-65535)
	Parameter 3	-

¹⁾ OP 73, OP 77A and TP 177A HMI devices also execute the "Screen selection" job mailbox if the on-screen keyboard is active.

7.3.3.8 "Data mailbox" area pointer

"Data mailbox" area pointer

Function

When data records are transferred between the HMI device and PLC, both partners access common communications areas on the PLC.

Data transfer types

There are two ways of transferring data records between the HMI device and PLC:

- Transfer without synchronization
- Transfer with synchronization over the data record

Data records are always transferred directly. That is, the tag values are read from an address or written to an address configured for this tag directly, without redirecting the values by means of interim memory.

Initiating the transfer of data records

There are three ways of triggering the transfer:

- Operator input in the recipe view
- PLC jobs

The transfer of data records can also be triggered by the PLC.

- Triggering by configured functions

If the transfer of data records is triggered by a configured function or by a PLC job, the recipe display on the HMI device remains operable. The data records are transferred in the background.

Simultaneous processing of several transfer requests is, however, not possible. In this case, the HMI device rejects the other transfer requests with a system alarm.

Transfer without synchronization

If you select asynchronous transfer of data records between the HMI device and PLC, there is no coordination over the common data areas. It is therefore unnecessary to set up a data area during configuration.

Asynchronous data record transfer can be a useful alternative, for example, when:

- The system is capable of excluding the risk of uncontrolled overwriting of data by the communication peer.
- The PLC does not require information about the recipe number and data record number.
- The transfer of data records is triggered by the operator of the HMI device.

Reading values

When a read job is triggered, the values are read from the PLC addresses and transferred to the HMI device.

- Triggering by the operator in the recipe view:
The values are downloaded to the HMI device. You can then process, edit, or save these values, for example.
- Triggering by a function or PLC job:
The values are saved immediately to the data volume.

Writing values

When a write job is triggered, the values are written to the PLC addresses.

- Triggering by the operator in the recipe view:
The current values are written to the PLC.
- Triggering by a function or PLC job:
The current values are written to the PLC from the data medium.

Transfer with synchronization (Omron)

If you select synchronous transfer, both communication partners set status bits in the common data area. You can use this mechanism to prevent uncontrolled overwriting of data in either direction in your control program.

Application

Synchronous data record transfer can be a useful solution, for example, when:

- The PLC is the "active partner" in the transfer of data records.
- The PLC evaluates the information about the recipe number and data record number.
- The transfer of data records is triggered by means of a Job mailbox.

Requirements

In order to synchronize transfer of data records between the HMI device and the PLC, the following requirements must be met during configuration:

- An area pointer has been set up: "Communication ► Connections" editor in "Area pointer"
- The PLC with which the HMI device synchronizes transfer of data records is specified in the recipe: "Recipes" editor, properties view of the recipe, "Properties" group in "Transfer".

Structure of the data area

The data area has a fixed length of 5 words. Structure of the data area:

	15		0
1. Word	Current recipe number (1 - 999)		
2. Word	Current data record number (0 - 65535)		
3. Word	Reserved		
4. Word	Status (0, 2, 4, 12)		
5. Word	Reserved		

- Status

The status word (word 4) can adopt the following values:

Value		Meaning
Decimal	Binary	
0	0000 0000	Transfer permitted, data record free
2	0000 0010	Transfer is busy
4	0000 0100	Transfer completed without error
12	0000 1100	Transfer completed with error

Possible causes of error when transferring data records

Possible causes of error

The section below shows possible error causes which lead to the cancellation of data record transfer:

- Tag address not set up on the PLC
- Overwriting data records not possible
- Recipe number does not exist
- Data record number does not exist

Note

The status word may only be set by the HMI device. The PLC may only reset the status word to zero.

Note

The PLC may only evaluate the recipe and data record numbers when data inconsistency is detected if one of the conditions outlined below has been met:

- The data mailbox status is set to "Transfer completed".
 - The data mailbox status is set to "Transfer completed with error".
-

Reaction to an aborted transfer due to errors

If the transfer of data records is aborted due to errors, the HMI device reacts as follows:

- Triggering by the operator in the recipe display
Information in the status bar of the recipe view and output of system alarms
- Triggered by function
Output of system alarms
- Triggering by PLC job
No feedback message on the HMI device

You can nonetheless evaluate the status of the transfer by querying the status word in the data record.

Sequence of the transfer when triggered by a configured function

Reading from the PLC using a configured function

Step	Action	
1	Check: Status word = 0?	
	Yes	No
2	The HMI device enters the recipe and data record number specified in the function and the status "Transfer active" in the data record.	Abort with system alarm.
3	The HMI device reads the values from the PLC and stores them in the data record specified in the function.	
4	<ul style="list-style-type: none"> • If "Yes" was selected for the "Overwrite" function, an existing data record is overwritten without any prompt for confirmation. The HMI device sets the status "Transfer completed." • If "No" was selected for the "Overwrite" function and the data record already exists, the HMI device aborts the job and enters 0000 1100 in the status word of the data record. 	
5	The control program must reset the status word to zero in order to enable further transfers.	

Writing to the PLC by means of configured function

Step	Action	
1	Check: Status word = 0?	
	Yes	No
2	The HMI device enters the recipe and data record number specified in the function and the status "Transfer active" in the data record.	Abort with system alarm.
3	The HMI device fetches the values of the data record specified in the function from the data medium and transfers the values to the PLC.	
4	The HMI device sets the status "Transfer completed."	
5	The control program can now evaluate the transferred data. The control program must reset the status word to zero in order to enable further transfers.	

Sequence of the transfer triggered by a job mailbox

The transfer of data records between the HMI device and the PLC can be initiated by either one of these stations.

The two PLC jobs No. 69 and No. 70 are available for this type of transfer.

No. 69: Read data record from PLC ("PLC → DAT")

PLC job no. 69 transfers data records from the PLC to the HMI device. The PLC job is structured as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	69
Word 2	Recipe number (1-999)	
Word 3	Data record number (1 to 65535)	
Word 4	Do not overwrite existing data record: 0 Overwrite existing data record: 1	

No. 70: Write data record to PLC ("DAT → PLC")

PLC job No. 70 transfers data records from the HMI device to the PLC. The PLC job is structured as follows:

	Left byte (LB)	Right byte (RB)
Word 1	0	70
Word 2	Recipe number (1-999)	
Word 3	Data record number (1 to 65535)	
Word 4	—	

Sequence when reading from the PLC with PLC job "PLC → DAT" (no. 69)

Step	Action	
1	Check: Status word = 0?	
	Yes	No
2	The HMI device enters the recipe and data record number specified in the job and the status "Transfer active" in the data record.	Abort without return message.
3	The HMI device reads the values from the PLC and saves these to the data record defined in the PLC job.	
4	<ul style="list-style-type: none"> If "Overwrite" was selected in the job, an existing data record is overwritten without any prompt for confirmation. The HMI device sets the status "Transfer completed." If "Do not overwrite" was selected in the job, and the data record already exists, the HMI device aborts the job and enters 0000 1100 in the status word of the data record. 	
5	The control program must reset the status word to zero in order to enable further transfers.	

Sequence of writing to the PLC using PLC job "DAT → PLC" (no. 70)

Step	Action	
1	Check: Status word = 0?	
	Yes	No
2	The HMI device enters the recipe and data record number specified in the job and the status "Transfer active" in the data record.	Abort without return message.
3	The HMI device fetches the values of the data record specified in the function from the data medium and writes the values to the PLC.	
4	The HMI device sets the status "Transfer completed."	
5	The control program can now evaluate the transferred data. The control program must reset the status word to zero in order to enable further transfers.	

Sequence of a transfer started by the operator in the recipe display**Reading from the PLC started by the operator in the recipe display**

Step	Action	
1	Check: Status word = 0?	
	Yes	No
2	The HMI device enters the recipe number to be read and the status "Transfer active" in the data record and sets the data record number to 0.	Abort with system alarm.
3	The HMI device reads the values from the PLC and displays them in the recipe display. If the recipes have synchronized tags, the values from the PLC are also written to the tags.	
4	The HMI device sets the status "Transfer completed."	
5	The control program must reset the status word to zero in order to enable further transfers.	

Writing to the PLC started by the operator in the recipe display

Step	Action	
1	Check: Status word = 0?	
	Yes	No
	The HMI device enters the recipe and data record number to be written and the status "Transfer active" in the data record.	Abort with system alarm.
2	The HMI device writes the current values to the PLC. If the recipes have synchronized tags, the changed values are synchronized between the recipe display and tags and then written to the PLC.	
3	The HMI device sets the status "Transfer completed."	
4	If required, the control program can now evaluate the transferred data.	
5	The control program must reset the status word to zero in order to enable further transfers.	

Note

The status word may only be set by the HMI device. The PLC may only reset the status word to zero.

Note

The PLC may only evaluate the recipe and data record numbers when data inconsistency is detected if one of the conditions outlined below has been met:

- The data mailbox status is set to "Transfer completed".
- The data mailbox status is set to "Transfer completed with error".

7.3.4 Events, alarms, and acknowledgments

7.3.4.1 General information on events, alarms, and acknowledgments

Function

Messages return information about the PLC or HMI device operating states or problems to the user on the HMI device. The message texts consist of configurable texts and/or tags with actual values.

Operational messages and events must be distinguished. The programmer defines what is an operational message and what is an error alarm.

Operational message

An operational message indicates a state. Example:

- Motor on
- PLC in manual mode

Alarm message

An error alarm indicates a malfunction. Example:

- Valve does not open.
- Excess motor temperature

Alarms indicate exceptional operational states, and must therefore be acknowledged.

Acknowledgment

To acknowledge error alarms:

- Operator input on the HMI device
- The PLC sets an acknowledgment bit.

Triggering alarms

Triggering of an alarm in the PLC:

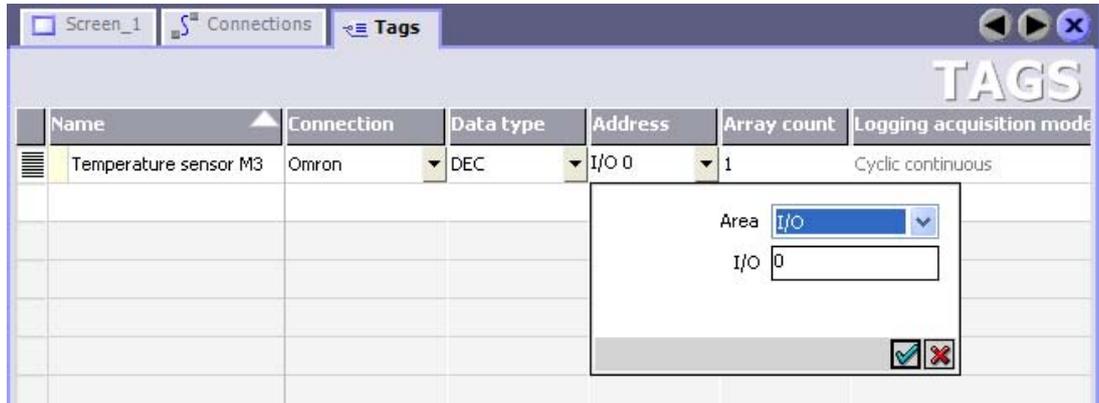
- Setting a tag bit
- Measured value limits exceeded

The location of tags, or of the tag array, is defined in WinCC flexible ES. The tag or array must be set up on the PLC.

7.3.4.2 Step 1: Creating tags or an array

Procedure

You create tags or arrays in the "Tags" editor. The dialog box is shown below.



- Define the tag and array names.
- Select the connection to the PLC.

The connection must already be configured in the "Connections" editor.

- Select the data type.

The available data types depend on the PLC being used. If you select an illegal data type the tag will not be available in the "Discrete alarms" and "Analog alarms" editors.

The following data types are supported for Omron controllers:

PLC	Permitted data types	
	Discrete alarms	Analog alarms
Series SYSMAC C, CV, CS1, alpha and CP	DEC, +/-DEC	BIN, DEC, +/-DEC, LDC, +/-LDC

- Enter an address.

The tag addressed here contains the bit that triggers the alarm.

As soon as the bit of the tag is set on the PLC and is transferred to the HMI device in the configured acquisition cycle, the HMI device recognizes the alarm as "incoming".

After the same bit is reset on the PLC, the HMI device recognizes the alarm as "outgoing".

- Select the array elements.

If the number of array elements is increased, you can select more bit numbers in the "Discrete alarms" editor. An array with a length of three words provides 48 alarm bits, for example.

7.3.4.3 Step 2: Configuring an alarm

Procedure

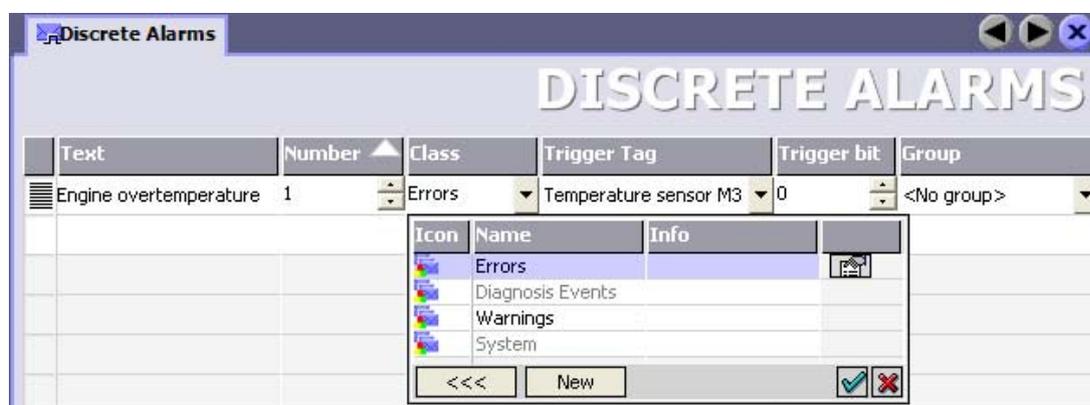
We differentiate between the following alarms:

- Discrete alarms
- Analog alarms

You create alarms in the "Discrete alarms" and "Analog alarms" editors.

Discrete alarms

The editor is shown in the figure below.



- Edit text

Enter the text to display in runtime. You can format the text characters. The text may contain fields for the output of tags.

The text is output to the alarm view if this view was configured in the "Screens" editor.
- Specify number

Every alarm has a number that must only occur once within the project. It is used to uniquely identify the alarm and is indicated with the alarm in runtime.

The permitted range of values is 1 to 100,000.

The WinCC flexible engineering system assigns consecutive numbers. You can change these when assigning alarm numbers to groups, for example.
- Specify the alarm class

Available alarm classes:

 - Error alarms

This class must be acknowledged.
 - Process events

This class signals events with incoming and outgoing alarms.

Communication with Omron controllers

7.3 User data areas

- Assign trigger tag

In the "Trigger tag" column, you link the configured alarm with the tag created in step 1. All tags with the permitted data type are shown in the selection list.

- Specify the bit number

In the "bit number" column, specify the relevant bit position in the created tag.

Remember that the way the bit positions are counted depends on the particular PLC. With Omron controllers, the bit positions are counted as follows:

How the bit positions are counted	Left byte								Right byte							
In Omron controllers	15							8	7							0
In the WinCC flexible, you configure the following:	15							8	7							0

Analog alarms

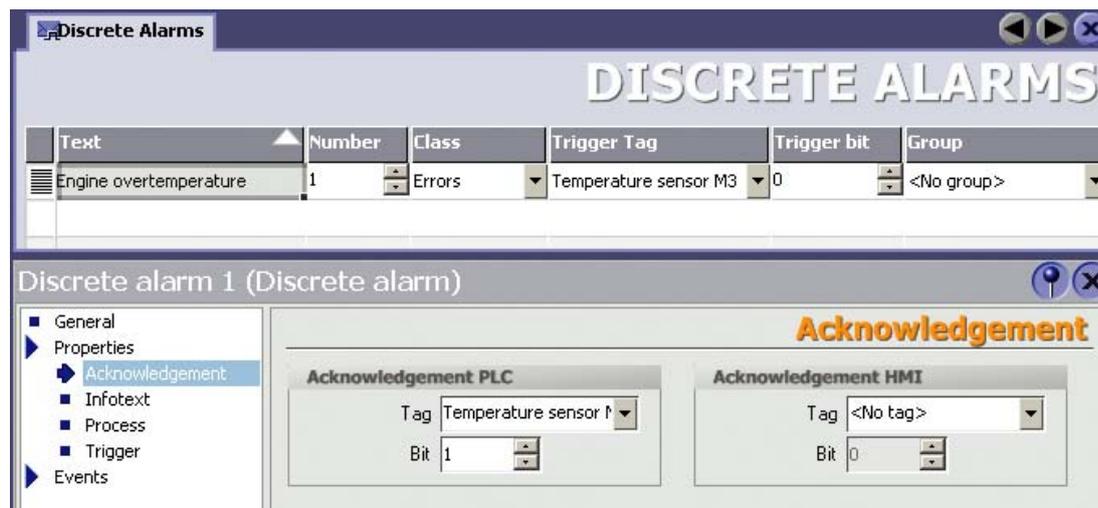
The only difference between discrete alarms and analog alarms is that you configure a limit value, rather than a bit number. The alarm is triggered when this limit is exceeded. The outgoing alarm is triggered when the low limit is violated, making allowances for any configured hysteresis.

7.3.4.4 Step 3: Configure the acknowledgment

Procedure

Create suitable tags on the PLC to acknowledge an error alarm. You assign these tags to an alarm in the "Bit messages" editor. You make the assignment in "Properties > Acknowledgment."

The following figure shows the dialog for configuring an acknowledgment.



Distinction in terms of acknowledgment:

- Acknowledgment on the HMI device
- Acknowledgment by the PLC

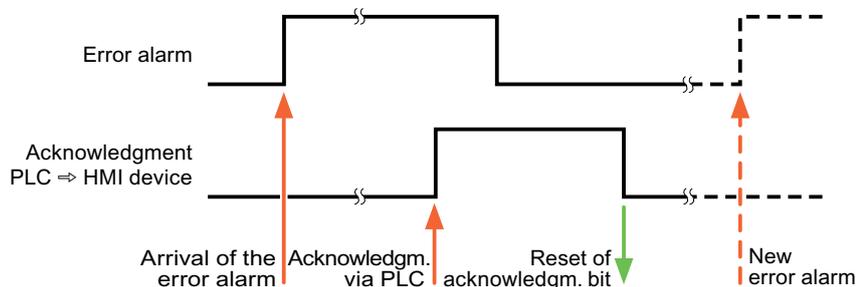
Acknowledgment by the PLC

In "Acknowledgment PLC tag", you configure the tag or the array tag and the bit number based on which the HMI device can recognize an acknowledgment by the PLC.

A bit set in the tag triggers acknowledgment of the assigned error alarm bit at the HMI device. This tag bit returns a function similar to acknowledgment on the HMI device which is triggered by pressing the "ACK" button, for example.

The acknowledgment bit must be located in the same tag as the bit for the error alarm.

Reset the acknowledgment bit before setting the bit in the alarm area again. The figure below shows the pulse diagram.



Acknowledgment on the HMI device

In "Ack read tag", you configure the tag or the array tag and the bit number that is written to the PLC after acknowledgment from the HMI device. Make sure when you use an array tag that it is not longer than 6 words.

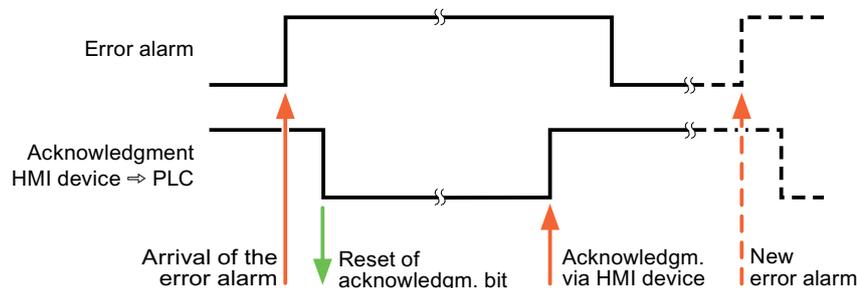
In order to ensure that a signal transition is generated as soon as the acknowledgment bit is set, the HMI device first resets the acknowledgment bit assigned to an error alarm. There is a certain time-based offset between these two operations, due to the processing time of the HMI device.

Note

The reset includes all alarm bits acknowledged since the last restart of Runtime. The PLC may only read this area once.

If the alarm is acknowledged on the HMI device, the bit is then set in the assigned acknowledgment tag on the PLC. This allows the PLC to recognize that the error alarm has been acknowledged.

The figure below shows the pulse diagram.



7.4 Commissioning components

7.4.1 Commissioning components

Transferring the PLC program to the PLC

1. Interconnect the PC with the CPU using the appropriate cable.
2. Download the program files to the CPU.
3. Then set the CPU to RUN.

Transferring project data to the HMI device

1. The HMI device must be in transfer mode in order to accept the project transfer.

Possible scenarios:

- Initial startup

The HMI device does not yet contain any configuration data in the initial startup phase. The project data and runtime software required for operation must be transferred from the configuration computer to the device: The HMI device automatically changes to transfer mode.

The transfer dialog box opens with a connection message on the HMI device.

- Recommissioning

Recommissioning means that you overwrite existing project data on the HMI device.

For corresponding detailed instructions, refer to the HMI device manual.

2. Check whether the alarm settings meet requirements of your WinCC flexible project.
3. Select "Project > Transfer > Transfer settings" to configure the transfer parameters before you transfer project data to the HMI device:
 - Select the used port.
 - Set the transfer parameters.
 - Select the target storage location.
4. Initiate the transfer of project data by clicking "Transfer".
 - The project is compiled automatically.
 - All compilation and transfer steps are logged to a message window.

Message output on the configuration computer on successful completion of the transfer: "Transfer completed successfully".

The start screen appears on the HMI device.

Interconnecting the PLC with the HMI device

1. Interconnect the PLC with the HMI device using a suitable cable.
2. The message "Connection to PLC is established" is output to the HMI device. Note that users can edit the system alarm texts in WinCC flexible.

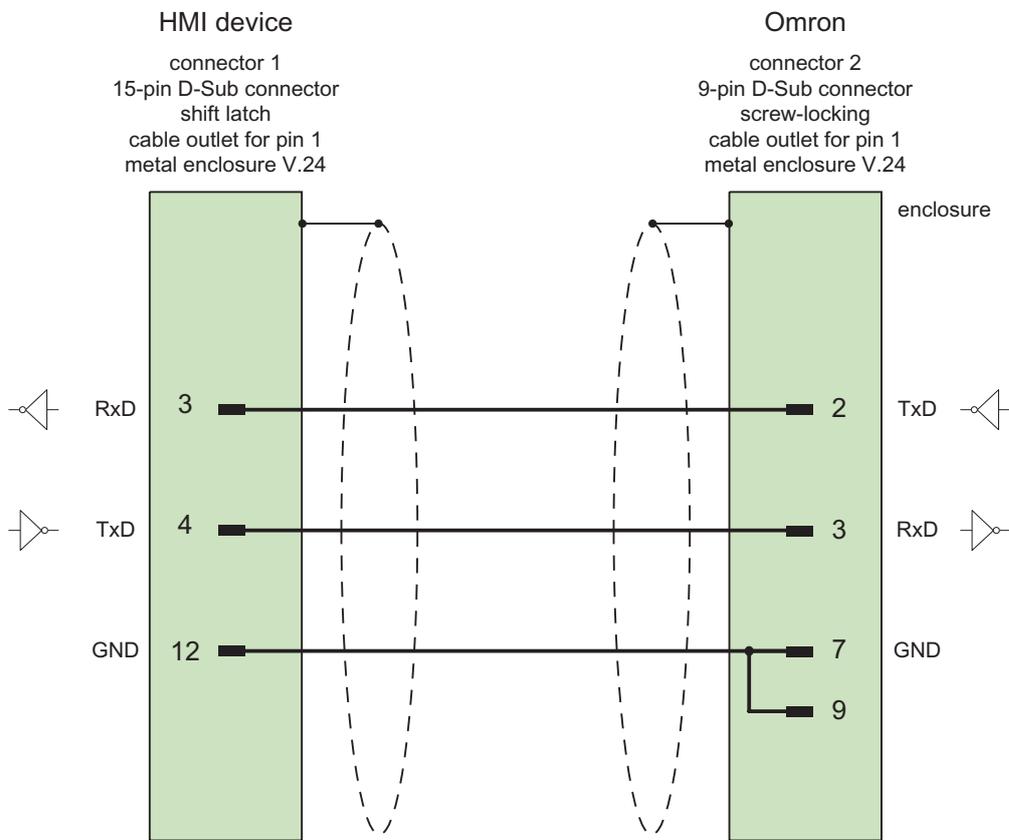
NOTICE
Always observe the safety-related information in the HMI device Manual when commissioning the device. RF radiation emitted from devices such as mobile phones may cause unwanted operating states.

7.5 Connecting cables for Omron Hostlink/Multilink

7.5.1 Connecting cable 6XV1440-2X, RS-232, for Omron

6XV1440 - 2X _ _ _ _

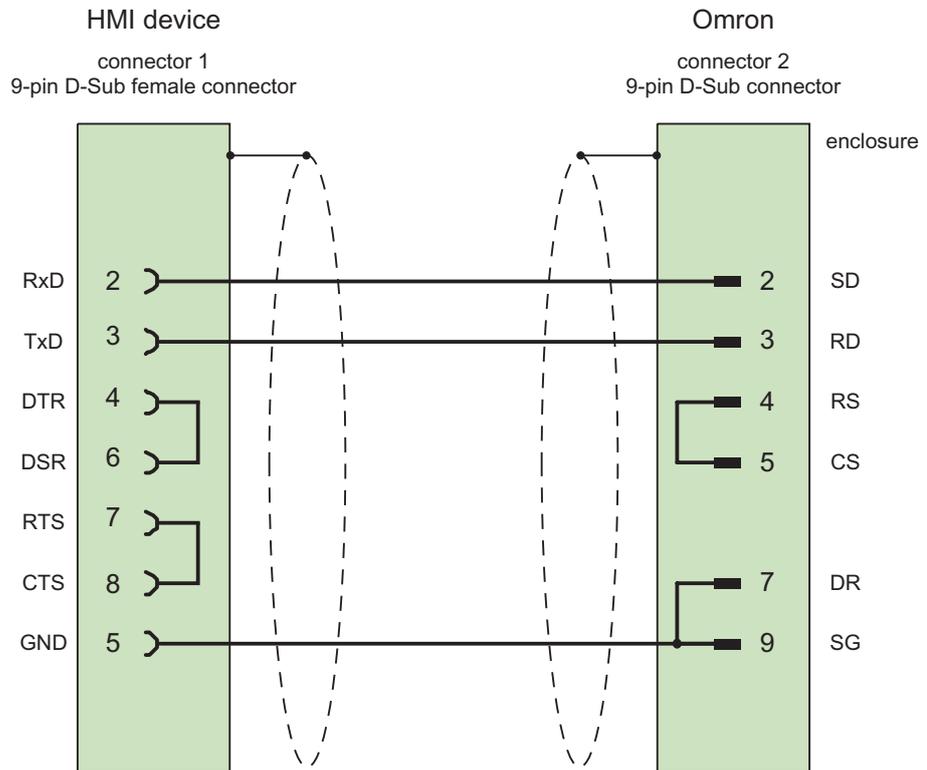
Length key, see catalog ST 80



Shield with large-area contact to casing
Cable: 5 x 0.14 mm², shielded,
max. length 15 m

7.5.2 Connecting cable PP1, RS-232, for Omron

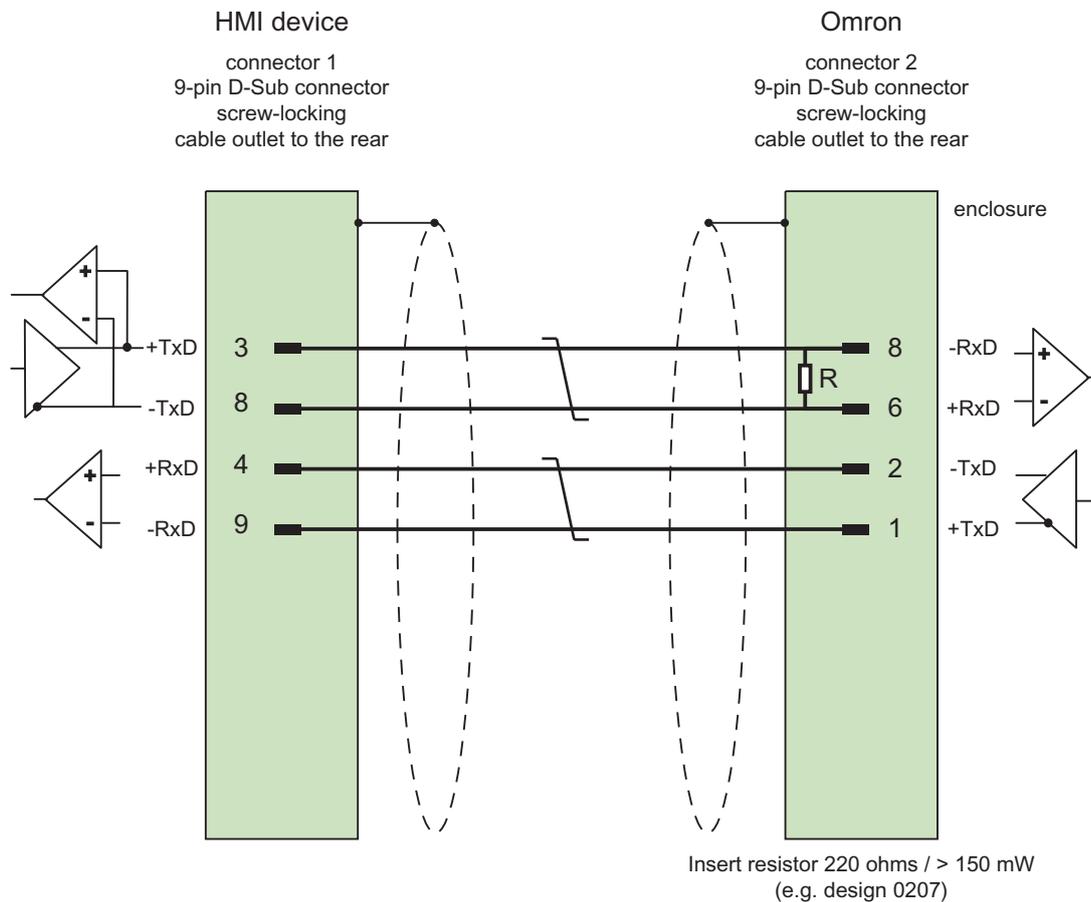
Point-to-point cable PP1, PC/TP/OP - PLC



Cables: 3 x 0.14 mm², shielded,
max. length 15 m

7.5.3 Connecting cable PP2, RS-422, for Omron

Point-to-point cable PP2, RS-422



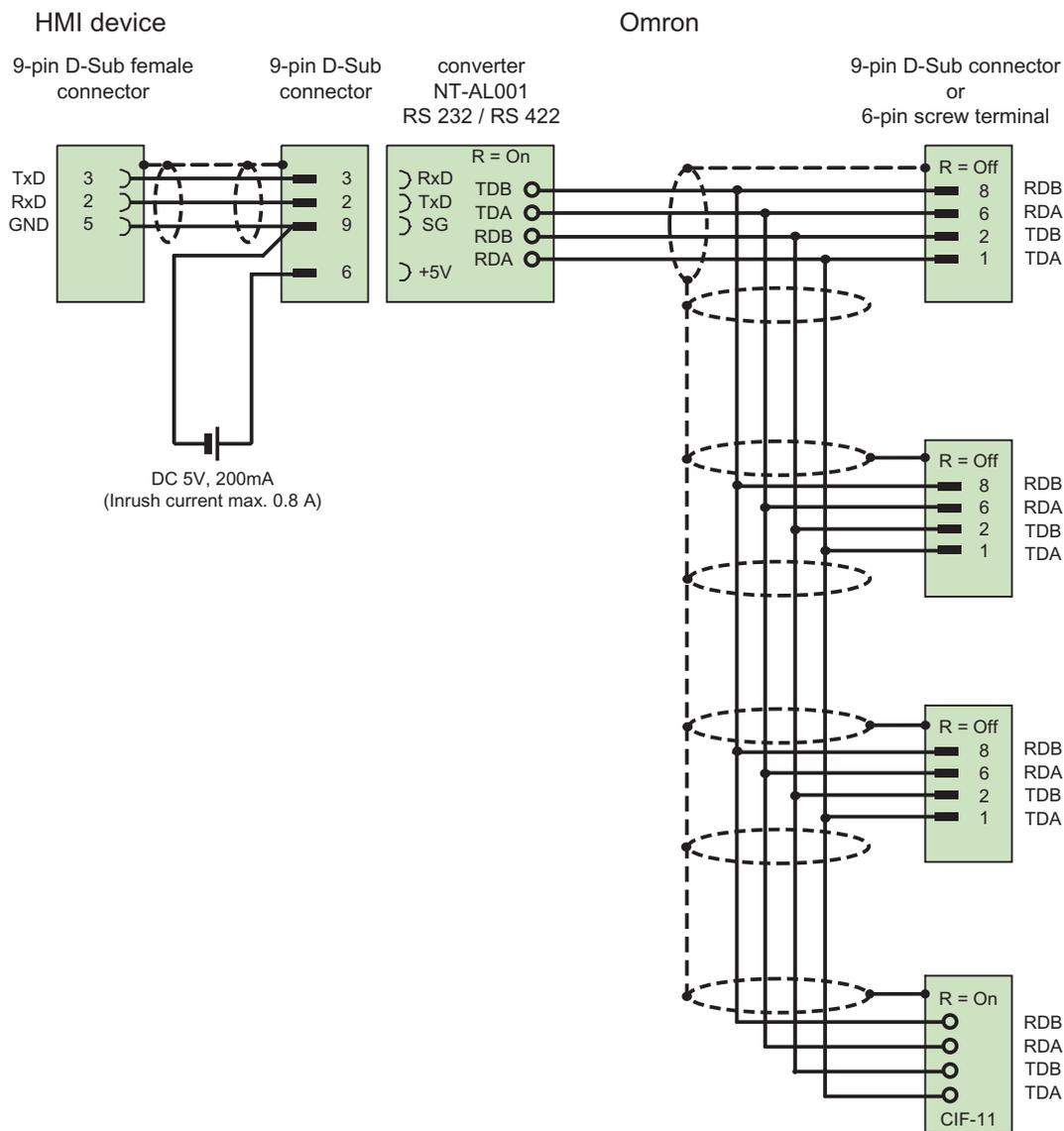
Cables: 3 x 0.14 mm², shield contacts connected,
max. length 500 m

Communication with Omron controllers

7.5 Connecting cables for Omron Hostlink/Multilink

7.5.4 Connecting cable MP1, RS-232, over converter, for Omron

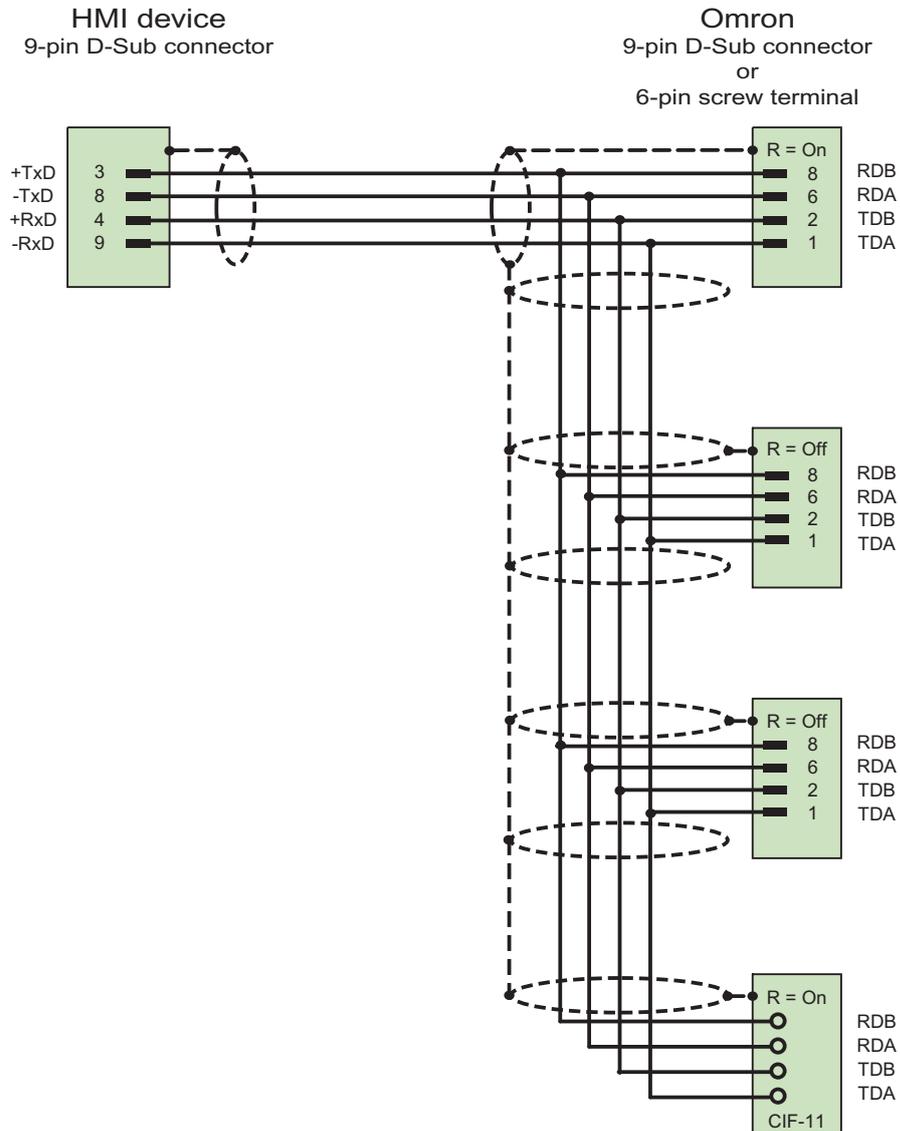
Multipoint cable 1: MP/TP/PC > PLC



1) Inrush current max. 0.8 A
 Cables: 5 x 0.14 mm², shielded,
 max. length 500 m

7.5.5 Connecting cable MP2, RS-422, for Omron

Multipoint cable 2: RS422, MP/TP/PC > SPS_



Cables: 5 x 0.14 mm², shielded,
 max. length 500 m

Communication with Omron controllers

7.5 Connecting cables for Omron Hostlink/Multilink
