

# Quantum using EcoStruxure™ Control Expert 140 ERT 854 10 Time Stamp Module User Manual

(Original Document)

12/2018

---

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

You agree not to reproduce, other than for your own personal, noncommercial use, all or part of this document on any medium whatsoever without permission of Schneider Electric, given in writing. You also agree not to establish any hypertext links to this document or its content. Schneider Electric does not grant any right or license for the personal and noncommercial use of the document or its content, except for a non-exclusive license to consult it on an "as is" basis, at your own risk. All other rights are reserved.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

© 2018 Schneider Electric. All rights reserved.

---

# Table of Contents

---



|                  |   |           |
|------------------|---|-----------|
|                  | <b>Safety Information</b> . . . . .   | <b>5</b>  |
|                  | <b>About the Book</b> . . . . .   | <b>9</b>  |
| <b>Part I</b>    | <b>Function Overview</b> . . . . .  | <b>11</b> |
| <b>Chapter 1</b> | <b>Introduction</b> . . . . .   | <b>13</b> |
|                  | Module Overview . . . . .   | <b>13</b> |
| <b>Chapter 2</b> | <b>User Functions and Services</b> . . . . .                                | <b>15</b> |
|                  | Input Processing - Registration and Filtering . . . . .                     | <b>16</b> |
|                  | Registration . . . . .  | <b>17</b> |
|                  | Filtering . . . . .   | <b>18</b> |
|                  | Input Data Processing . . . . .   | <b>20</b> |
|                  | Status Inputs . . . . .   | <b>22</b> |
| <b>Chapter 3</b> | <b>Time Synchronization</b> . . . . .                                       | <b>23</b> |
|                  | Time Synchronization with Standard Time . . . . .                           | <b>23</b> |
| <b>Chapter 4</b> | <b>Typical Application Areas</b> . . . . .                                  | <b>25</b> |
|                  | Typical areas of application . . . . .                                      | <b>25</b> |
| <b>Part II</b>   | <b>Module Description</b> . . . . .   | <b>27</b> |
| <b>Chapter 5</b> | <b>Module Description</b> . . . . .   | <b>29</b> |
|                  | Overview . . . . .  | <b>30</b> |
|                  | Features and Functions . . . . .  | <b>32</b> |
|                  | Planning . . . . .  | <b>33</b> |
|                  | Module Cabling . . . . .  | <b>34</b> |
|                  | Diagnosis . . . . .   | <b>37</b> |
|                  | Technical data . . . . .  | <b>38</b> |
| <b>Part III</b>  | <b>Configuration</b> . . . . .  | <b>41</b> |
| <b>Chapter 6</b> | <b>Quantum Addressing Modes</b> . . . . .                                   | <b>43</b> |
|                  | Flat Addressing—800 Series I/O Modules . . . . .                            | <b>44</b> |
|                  | Topological Addressing—800 Series I/O Modules with Control Expert . . . . . | <b>45</b> |
|                  | Addressing Example . . . . .  | <b>46</b> |
|                  | Discrete I/O Bit Numbering . . . . .  | <b>47</b> |
|                  | Addressing . . . . .  | <b>48</b> |
| <b>Chapter 7</b> | <b>The Parameter Configuration Window</b> . . . . .                         | <b>49</b> |
|                  | The Parameter Configuration Window . . . . .                                | <b>49</b> |

---

|                   |   |           |
|-------------------|---|-----------|
| <b>Chapter 8</b>  | <b>Startup the 140 ERT 854 10</b> .....   | <b>55</b> |
|                   | 140 ERT 854 10 Module and Resource Limitations. ....  | 56        |
|                   | DCF Receiver. ....  | 57        |
|                   | The GPS Receiver. ....  | 58        |
|                   | Behaviour when starting/restarting and the data storage. ....   | 59        |
|                   | Check List .....  | 61        |
| <b>Chapter 9</b>  | <b>Integration in the Application Program</b> .....   | <b>63</b> |
|                   | Integrating Intelligent I/O Modules .....   | 64        |
|                   | Configuration Section. ....   | 65        |
|                   | Processing Section .....  | 66        |
| <b>Chapter 10</b> | <b>EFBs for the 140 ERT 854 10</b> .....  | <b>67</b> |
| 10.1              | DROP: Configuring an I/O station rack .....   | 68        |
|                   | Description .....   | 68        |
| 10.2              | QUANTUM: Configuring a main rack .....  | 71        |
|                   | Description .....   | 71        |
| 10.3              | ERT_854_10: Data transfer EFB .....   | 74        |
|                   | Description .....   | 75        |
|                   | Function mode .....   | 80        |
|                   | EFB configuration. ....   | 82        |
|                   | Data Flow. ....   | 83        |
|                   | Other Functions .....   | 88        |
|                   | Use of the <code>DPM_Time</code> structure for the synchronization of the internal<br>ERT clock ..... | 89        |
|                   | Using the ERT >EFB Time Data Flow .....   | 90        |
| <b>Index</b>      | .....   | <b>91</b> |

---

# Safety Information

---



## Important Information

### NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, service, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a “Danger” or “Warning” safety label indicates that an electrical hazard exists which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

## **DANGER**

**DANGER** indicates a hazardous situation which, if not avoided, **will result in** death or serious injury.

## **WARNING**

**WARNING** indicates a hazardous situation which, if not avoided, **could result in** death or serious injury.

## **CAUTION**

**CAUTION** indicates a hazardous situation which, if not avoided, **could result in** minor or moderate injury.

## **NOTICE**

**NOTICE** is used to address practices not related to physical injury.

---

## PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

## BEFORE YOU BEGIN

Do not use this product on machinery lacking effective point-of-operation guarding. Lack of effective point-of-operation guarding on a machine can result in serious injury to the operator of that machine.

### **WARNING**

#### **UNGUARDED EQUIPMENT**

- Do not use this software and related automation equipment on equipment which does not have point-of-operation protection.
- Do not reach into machinery during operation.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

This automation equipment and related software is used to control a variety of industrial processes. The type or model of automation equipment suitable for each application will vary depending on factors such as the control function required, degree of protection required, production methods, unusual conditions, government regulations, etc. In some applications, more than one processor may be required, as when backup redundancy is needed.

Only you, the user, machine builder or system integrator can be aware of all the conditions and factors present during setup, operation, and maintenance of the machine and, therefore, can determine the automation equipment and the related safeties and interlocks which can be properly used. When selecting automation and control equipment and related software for a particular application, you should refer to the applicable local and national standards and regulations. The National Safety Council's Accident Prevention Manual (nationally recognized in the United States of America) also provides much useful information.

In some applications, such as packaging machinery, additional operator protection such as point-of-operation guarding must be provided. This is necessary if the operator's hands and other parts of the body are free to enter the pinch points or other hazardous areas and serious injury can occur. Software products alone cannot protect an operator from injury. For this reason the software cannot be substituted for or take the place of point-of-operation protection.

Ensure that appropriate safeties and mechanical/electrical interlocks related to point-of-operation protection have been installed and are operational before placing the equipment into service. All interlocks and safeties related to point-of-operation protection must be coordinated with the related automation equipment and software programming.

---

**NOTE:** Coordination of safeties and mechanical/electrical interlocks for point-of-operation protection is outside the scope of the Function Block Library, System User Guide, or other implementation referenced in this documentation.

## START-UP AND TEST

Before using electrical control and automation equipment for regular operation after installation, the system should be given a start-up test by qualified personnel to verify correct operation of the equipment. It is important that arrangements for such a check be made and that enough time is allowed to perform complete and satisfactory testing.

### **WARNING**

#### **EQUIPMENT OPERATION HAZARD**

- Verify that all installation and set up procedures have been completed.
- Before operational tests are performed, remove all blocks or other temporary holding means used for shipment from all component devices.
- Remove tools, meters, and debris from equipment.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

Follow all start-up tests recommended in the equipment documentation. Store all equipment documentation for future references.

#### **Software testing must be done in both simulated and real environments.**

Verify that the completed system is free from all short circuits and temporary grounds that are not installed according to local regulations (according to the National Electrical Code in the U.S.A, for instance). If high-potential voltage testing is necessary, follow recommendations in equipment documentation to prevent accidental equipment damage.

Before energizing equipment:

- Remove tools, meters, and debris from equipment.
- Close the equipment enclosure door.
- Remove all temporary grounds from incoming power lines.
- Perform all start-up tests recommended by the manufacturer.

---

## OPERATION AND ADJUSTMENTS

The following precautions are from the NEMA Standards Publication ICS 7.1-1995 (English version prevails):

- Regardless of the care exercised in the design and manufacture of equipment or in the selection and ratings of components, there are hazards that can be encountered if such equipment is improperly operated.
- It is sometimes possible to misadjust the equipment and thus produce unsatisfactory or unsafe operation. Always use the manufacturer's instructions as a guide for functional adjustments. Personnel who have access to these adjustments should be familiar with the equipment manufacturer's instructions and the machinery used with the electrical equipment.
- Only those operational adjustments actually required by the operator should be accessible to the operator. Access to other controls should be restricted to prevent unauthorized changes in operating characteristics.



---

# About the Book

---



## At a Glance

### Document Scope

This document describes the functionality and performance scope of the Time Stamp Module 140 ERT 854 10. It should show you how to provide your Quantum with time stamped data.

### Validity Note

This documentation is valid for EcoStruxure™ Control Expert 14.0 or later.

### Related Documents

| Title of documentation   | Reference number  |
|--|---|
| EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual | 35006144 (English),<br>35006145 (French),<br>35006146 (German),<br>35013361 (Italian),<br>35006147 (Spanish),<br>35013362 (Chinese) |
| EcoStruxure™ Control Expert, I/O Management, Block Library                     | 33002531 (English),<br>33002532 (French),<br>33002533 (German),<br>33003684 (Italian),<br>33002534 (Spanish),<br>33003685 (Chinese) |

You can download these technical publications and other technical information from our website at [www.schneider-electric.com/en/download](http://www.schneider-electric.com/en/download).



---

# Part I

## Function Overview

---

### Overview

The first part of the manual for the intelligent input module 140 ERT 854 10 gives an overview of the structure of the module, the functionality and shows typical applications.

### What Is in This Part?

This part contains the following chapters:

| Chapter | Chapter Name                | Page |
|---------|-----------------------------|------|
| 1       | Introduction                | 13   |
| 2       | User Functions and Services | 15   |
| 3       | Time Synchronization        | 23   |
| 4       | Typical Application Areas   | 25   |



---

# Chapter 1

## Introduction

---

### Module Overview

#### Overview

The 140 ERT 854 10 is an intelligent 32 point input module for Quantum that allows full configuration of inputs and evaluates the input signal status every 1 millisecond.

#### The inputs

The 32 inputs are designed for input voltages of 24 to 125 VDC and are distributed in 2 independent groups. Each group is supplied with a separate external reference voltage (typically 24, 48, 60 or 125 VDC), to influence the threshold limit and minimum current consumption. The module status Ready, Active and Error as well as the input status (status of the terminals) are clearly displayed by the status LEDs on the module.

**NOTE:** The reference input voltage must be identical to the input voltage level.

140 ERT 854 10 firmware processes inputs in four separate configurable function blocks with 8 inputs which support the following functions that can be selected.

- Binary inputs: input values are sent cyclically to the PLC.
- Event inputs: Time registered event logging for 1, 2 or 8 processed inputs, with 5 byte time register, integrated FIFO buffer for 4096 events and acknowledging PLC transfer by the user.
- Counter inputs: 32 bit addition of processed events up to 500 Hz that are transferred cyclically to the PLC.

Parameters can be set for processing individual inputs: (disabled, inverted, and with debounce filter). A configurable chatter filter can be activated for the event and counter inputs and event edge monitoring carried out.

#### Time synchronization

The module clock requires a time synchronization signal and provides a 24 VDC input with potential isolation for the following standard time receiver with DCF 77 format.

- DCF 77E (long wave reception only in Europe)

The ERT internal software clock can alternatively be created by the application program, or be free running.

#### Validity reserve

A validity reserve can determine how long the module clock can continue running without external synchronization. For further information see *Time Synchronization with Standard Time*, [page 23](#).

### **Power reserve**

The ERT data evaluated can be buffered with a maximum current consumption of 0.07 mA by the 140 XCP 900 00 battery module in the event of power loss.

---

# Chapter 2

## User Functions and Services

---

### Overview

The 32 inputs of the 140 ERT 854 10 module can be individually preprocessed and transferred to the PLC as binary value, counter value or event. The following chapter describes the functions and services available.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic   | Page |
|---|------|
| Input Processing - Registration and Filtering | 16   |
| Registration                                  | 17   |
| Filtering                                     | 18   |
| Input Data Processing                         | 20   |
| Status Inputs                                 | 22   |

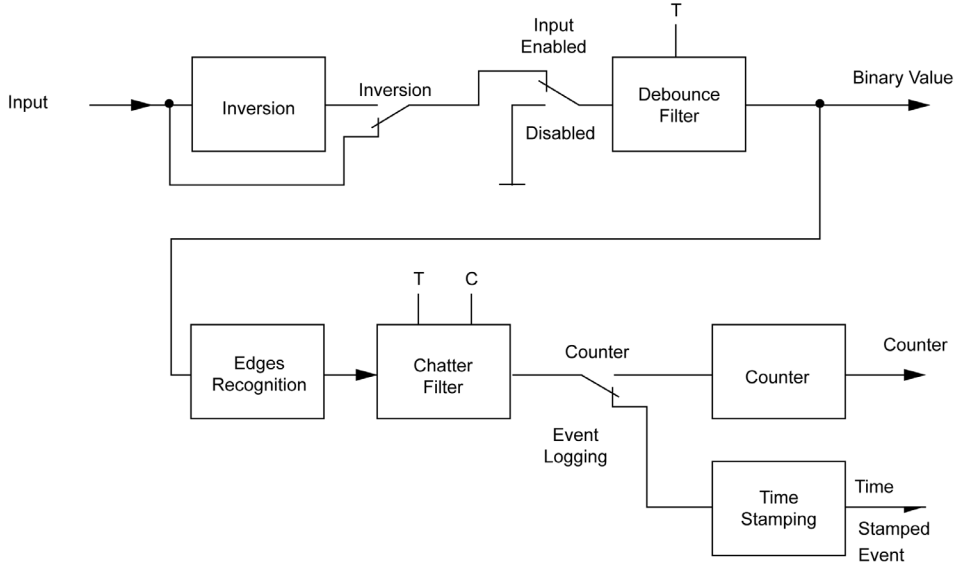
## Input Processing - Registration and Filtering

### Overview

The input signals connected to the 140 ERT 854 10 go through a multistage preprocessing stage before they are made available to the user program as binary, counter values or events. The preprocessing can be set with parameters for each individual input.

### Signal Processing Sequence

The processing of the input signals is carried out according to the parameters set. Parametering is carried out via a Parameter configuration window (*see page 49*).





## Registration

### Overview

The processing of the individual inputs is completely configurable: (disabled, inverted and with debounce time). The events and counter inputs can also have a configurable chatter filter activated and an edge event evaluation.

### Disabling

A disabled input always shows the value "0" independent for its input state.

### Inverting

The input polarity is inverted before further processing. If this is active, the opposite to the input signal status shown on the status LEDs is passed on for further processing.

### Edge Recognition

Selects the edge transitions which should be used for active events and counter inputs. "Both Edges" processes rising and falling edges. Otherwise only a signal edge is processed: rising/falling, either with or without active inversion.

## Filtering

### Overview

The configurable filtering is done in 2 stages: debounce and dechattering.

### ⚠ CAUTION

#### UNEXPECTED APPLICATION BEHAVIOR - INCORRECT INTERPRETATION OF INPUT DATA

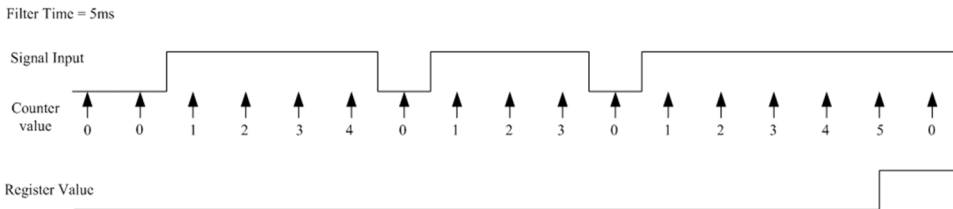
Filters are used to suppress the input recognition in a defined way. Filtering should only be used in a suitable way to prevent too much or undesired suppression of input data.

**Failure to follow these instructions can result in injury or equipment damage.**

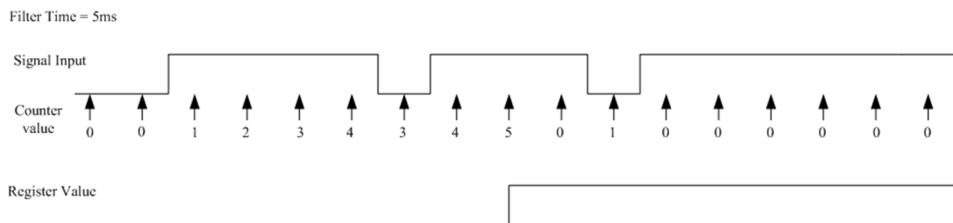
### Debounce

Debouncing can be used on all input functions and prevents the processing of fast state changes of the inputs, like for example, those caused by contact bouncing. Signal changes are ignored depending on the filter type and the preset time. The value range for the filter time is 0 to 255 ms; the value 0 deactivates the debounce filter. The selection of the debounce filter type "stable signal" or "integrating" affects all 8 inputs per function block.

- "Stable Signal" Filtering: A signal change is only registered if the polarity change stays stable for longer than the filter time (each new change resets the filter time).



- "Integrating" Filtering: A signal change is only registered if the time integral of the input signal reaches the programmed filter time taking any polarity change into account.



**NOTE:** Debounce time  $\geq 1$  ms is recommended to ensure enough immunity against electromagnetic disturbances. This means that input signal states  $\geq 2$  ms and events up to 250 Hz can be processed. In non-critical electromagnetic environments, the debounce time can be set to 0 to avoid unnecessary filter delays. This means that input signal states  $\geq 1$  ms and events up to 500 Hz can be processed.

## Dechattering

Dechattering can only be used for event and counter inputs. It limits the number of events to a configurable value during a configurable time period. This should prevent multiple event registrations for the same input, e.g. disturbance influences due to slowly changing inputs (because the hysteresis is possibly set too small). The chatter counter is configurable for each individual input, the chatter time for each input pair. The selection of "dechattering" on the parameter screen activates the chatter filter for all 8 inputs per function block. The chatter filtering for individual inputs can always be disabled by selecting the value of 0 as chatter count value. A "Chatter Filter Active" bit within the "status" output word (Bit 7 - DC) which is returned from the transfer EFB "ERT\_854\_10" (see *ERT\_854\_10: Data transfer EFB, page 74*) signals that at least one "Chatter" input is being filtered. The bit is reset as soon as the chatter time of the last active filtered input has run out.

- Chatter time: The time period in which the chatter count limit has an effect. Value range from 1... 255 \* 100 milliseconds = 0.1... 25.5 seconds.
- Chatter count: The maximum number of registered events which are allowed to be passed on within the chatter time period. Value range from 1... 255, the value 0 deactivates the chatter filter.

**NOTE:** Dechattering is a very powerful processing tool which can have undesired side effects. Its use with counter inputs is questionable. If edge recognition is performed for "both edge" then, in case of odd-numbered chatter suppression, 2 successive events with the same edge (2 rising, 2 falling) appear when transferred to the PLC.

### CAUTION

#### UNEXPECTED APPLICATION BEHAVIOR

Do not perform odd-numbered chatter suppression in case of both edge recognition.

**Failure to follow these instructions can result in injury or equipment damage.**

## Input Data Processing

### Overview

The input signal can be used as binary inputs, counter values or for event recording depending on the parameters set in the Parameter configuration window (*see page 49*).

Normally the input data of the ERT 854 10 module is processed by the corresponding EFBs (see *EFBs for the 140 ERT 854 10, page 67*)

### Binary Inputs

All inputs of the function block are transferred to the PLC after the third processing stage (i.e. enabling, inverting and debounce filtering) before the chatter filter and edge recognition are performed. The processed values of all 32 inputs are cyclically transferred (every PLC cycle) to the first and second input register word of the 7 word %IW register block of the ERT. The address sequence of the module inputs corresponds to standard digital input modules, i.e. inputs 1 ... 16 correspond to bits 15...0. User confirmation is not necessary because the EFB ERT\_854\_10 must exist and be enabled. The processed values are available for all 32 inputs independent of their further processing as counter or event inputs. The input processing is always executed according to the configuration, but the ERT copies the processed values from the input immediately after the third input processing stage !

**NOTE:** If the BoolArr32 output array "Input" of the "ERT\_854\_10"-Transfer EFB (see *ERT\_854\_10: Data transfer EFB, page 74*) is configured, the processed values are directly available as Bool values.

### Counter Values

All inputs of the function block go through all five input processing stages (i.e. enabling, inverting, debounce and chatter filtering as well as edge recognition). The count operation executes once edge recognition has been performed successfully. For edge recognition which is not set as "both edges", the configured inverting decides if rising or falling edges are counted.

**NOTE:** It is probably not worthwhile using inversion for the recognition of "both edges"

Counter values are 32 bit totals. The PLC receives a complete sequence (configured as: 8, 16, 24 of 32) of time consistent counter values in a multiplex procedure from the "ERT\_854\_10" transfer EFB cyclically (see description of the EFB, section *EFBs for the 140 ERT 854 10, page 67*). The EFB sets the values in the configured UDINTArr32 output array "Cnt\_Data", without the confirmation of the user. After the transfer of the new counter values is completed, the EFB sets the signal "New Data", a Boolean variable "ND\_Count", for one PLC cycle.

**NOTE:** The transfer of the counter values starts with function block 1 and ends with the last function block which is configured as counter inputs. If a consecutive sequence of function blocks starting with the first block are configured as counter inputs, transfer resources are saved. Since the transfer of the counter values competes with the transfer of the recorded events, faster reaction times for both types can be achieved if an ERT module is fully configured as either a counter or an event input. Binary and status inputs have no effect on this.

## Event Logging

This function allows input state changes to be registered in time order with a high resolution. The input state changes are logged with a time stamp with a high resolution. The events can later be shown in the correct sequence. The time stamping of events can be configured so that a group of 1, 2 or 8 inputs can be processed in parallel. All inputs of the function block go through all five input processing stages (i.e. enabling, inverting, debounce and chatter filtering as well as edge recognition). The logging (including time stamping) is done as soon as the edge reaches the edge recognition. For edge recognition which is not set as "both edges", the configured inverting decides if rising or falling edges are logged.

**NOTE:** Inversion is probably not sensible to use with the recognition of "both edges".

A group of inputs is logged as an event if at least one of the inputs in this group has an edge which has been recognized, i.e.:

- any single input (1, 2 ... 7, 8),
- any input of an input pair (1-2, 3-4, 5-6, 7-8),
- an input of an 8 bit group.

Events contain a lot of information in an 8 byte block, including the processed values of all inputs in the group with the corresponding time stamp:

- Module number
- Type of input group and number of the first bit
- The current value of the inputs in the group
- Time stamp: Milliseconds
- Time stamp: Minute
- Time stamp: Hour
- Time stamp: Day of the week / Day in the month

The actual value of the inputs is stored right justified in an event structure byte. The ERT saves up to 4096 events in its battery backed FIFO buffer. The ERT provides error bits (bit 5/6 - PF/PH) for buffer overflow/buffer half full within the "Status" output word which is returned from the "ERT\_854\_10" transfer EFB. Individual events are transferred in a "ERT\_10\_TTag" structure to the PLC by the "ERT\_854\_10" transfer EFB. After processing the events, the user must actively signal readiness for the receiving of new events. See EFB description *ERT\_854\_10: Data transfer EFB, page 74*. If desired, the parameter "Complete time report" can be selected to provide the month and year. For this purpose, there is a special pseudo event without values which contains the complete time information with month and year. The event is marked as a "Complete time report" and precedes the "actual", time stamped event. (See additional information about "Complete Time Report" in *Parameters and Default Values, page 50*).

## Status Inputs

### Status word

The "Status" output word which is cyclically returned by the "ERT\_854\_10" transfer EFB contains the following error bits:

- D8 ... D0 ERT error bits
- D11 ... D9 reserved
- D15 ... D12 EFB error bits

A complete description of the error bits is in the *Division of the Error Bits*, [page 85](#)

After the transfer of the new status inputs is completed, the EFB sets the signal "New Data", a Boolean variable from "ND\_Stat", for one cycle.

**NOTE:** ERT/EFB error messages are displayed in the Control Expert screen **Tools** → **Diagnostic Viewer** with the error number and explanation (see *Online error display*, [page 87](#)).

---

# Chapter 3

## Time Synchronization

---

### Time Synchronization with Standard Time

#### Overview

The time stamped event logging requires a precise internal clock. The ERT module uses a software clock for creating the time in millisecond intervals. This software clock is normally synchronized with the help of an external time signal (standard time receiver) in one minute intervals. It can also be synchronized via a telegram or be free running.

The incoming time signal is checked for plausibility. Runtime deviations from the software clock are corrected. The time reception takes a few minutes before the time becomes available after startup. The software clock is synchronized to this time. The module then determines the deviation from the software clock with regard to the external clock within a specific period, and offsets the deviation accordingly. This is carried out continuously during the entire runtime. After a few hours runtime (generally within 2 hours) the software clock reaches maximum precision.

If implausible or incorrect time messages are received, the software clock continues running without synchronization. The deviation gets larger during this time. If this time phase does not exceed the "Validity Reserve" specified, the clock resynchronizes when the next valid time information is received. However, if the time period is exceeded before the module receives a valid time signal, the ERT sets bit "Time Invalid" in the "Status" output word (bit 3 - TU), returned by the "ERT\_854\_10" transfer EFB (see *ERT\_854\_10: Data transfer EFB, page 74*). All time stamps set after this are invalid (the high priority byte for millisecond information is set to FF). The bit is reset as soon as the next valid time message is received.

If the module receives no valid time messages for 10 minutes, the ERT sets the bit "Time Reference Error" in the "Status" output word (bit 2 - TE), returned by the "ERT\_854\_10" transfer EFB (see *ERT\_854\_10: Data transfer EFB, page 74*). The bit is reset as soon as the next valid time message is received.

#### Synchronization

The synchronization is possible by the PLC using "ERT\_854\_10" EFB (low precision).

### DCF Time base

The DCF 77E receiver delivers a 24VDC signal in DCF77 format and can supply up to 16 ERT modules concurrently. The BCD coded time signal is transferred once a minute and synchronizes the ERT minutes changeover. When the ERT is restarted the software clock is synchronized within three minutes of receiving the first information. After this the ERT software clock time matches the standard time sender. If the send signal becomes unavailable the free running software clock can still be used but is not as precise. The DCF sender delivers CET (Central European Time), takes into account summer/winter time changes as well as seconds and years transitions.

### GPS Time base

A GPS receiver must be used for applications which use GPS satellite time references. The module demodulates the GPS signal and delivers DCF77 format output signal from 24 VDC. The ERT decodes the signal and synchronizes the minutes transition for the internal software clock. GPS satellites sends UTC time (Universal Time Coordinated) which GMT (Greenwich Mean Time = Western European Time) corresponds to. Seconds and years transitions are taken into account. The recommended validity reserve for the DCF/GPS time base signal is one hour (the settings range for DCF/GPS sync is between 1 and 5 hours). Several ERT modules can be synchronized simultaneously using a GPS receiver.

### EFB synchronized internal clock

If a clock only requires a lower precision, the ERT internal software clock can be synchronized with a time value sent by the master. The software clock runs freely until the next time value is received. Precision is usually within 100 milliseconds per hour and the software clock must be synchronized correspondingly often. The "ERT\_854\_10" transfer EFB provides the required time synchronization. This means several ERT modules can be supplied with almost the same time; the time source used is the derived data structure "DPM\_Time". The validity reserve setting for the EFB synchronized internal software clock moves between 1 and 254 hours). However, if the time period is exceeded before the next transfer of a time signal, the ERT sets bit "Time Invalid" in the "Status" output word (bit 3 - TU), returned by the "ERT\_854\_10" transfer EFB. All time stamps set after this are invalid (the high priority byte for millisecond information is set to FF). The bit is reset as soon as the next valid time message is received.

### Free running internal clock

The ERT internal software clock can also be used on its own. Setting the validity reserve for the internal software clock to 0 activates duration mode, shown by the bit "Time not synchronized" in the "Status" output word (bit 4 - TA) which is returned by the "ERT\_854\_10" transfer EFB. In this case there is no validity reserve that can be exceeded and therefore no invalid time stamps. The bits "External Reference Error" and "Time Invalid" in the output word "Status" (Bit 2/3 - TE/TU) are never set; the time starts automatically without synchronization. The default start settings for the internal clock is 0 hours, 1/1/1990. The time settings can be made using:

- a telegram (e.g. by IEC 870-5-101)
- the CPU clock (using the "DPM\_Time" data structure)



---

# Chapter 4

## Typical Application Areas

---

### Typical areas of application

#### Overview

The ERT 854 10 is particularly suited for determining the binary input status and counter value that require a time stamp

#### 140 ERT 854 10 Applications

The following areas of application are valid for the 140 ERT 854 10:

- Processing binary inputs: Use as a standard I/O module with filtering and an input range of 24 - 125 VDC.
- Event Logging: The event of an individual process status can be logged with the corresponding time (time stamp). This enables the later reconstruction of the time point and the sequence of process signals "coming" or "going".
- Counter value: Use as a standard I/O module (with filtering, 32 bit summing with max. 500 Hz) with an input range of 24 - 125 VDC.
- Periodic time stamping of process values: Recording counter values in defined time intervals. The combined use of both function groups can be used as an advantage here.
- Time dependent switching actions: Outputs can be set regardless of time for controlling lighting, heating, ventilators, temperatures (building automation), or for opening/closing doors, machines, ... (safety measures). The output status can be recorded with the ERT.



---

## Part II

### Module Description

---



---

# Chapter 5

## Module Description

---

### Overview

This chapter provides information about the structure of the 140 ERT 854 10 module and its technical data.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic                  | Page |
|------------------------|------|
| Overview               | 30   |
| Features and Functions | 32   |
| Planning               | 33   |
| Module Cabling         | 34   |
| Diagnosis              | 37   |
| Technical data         | 38   |

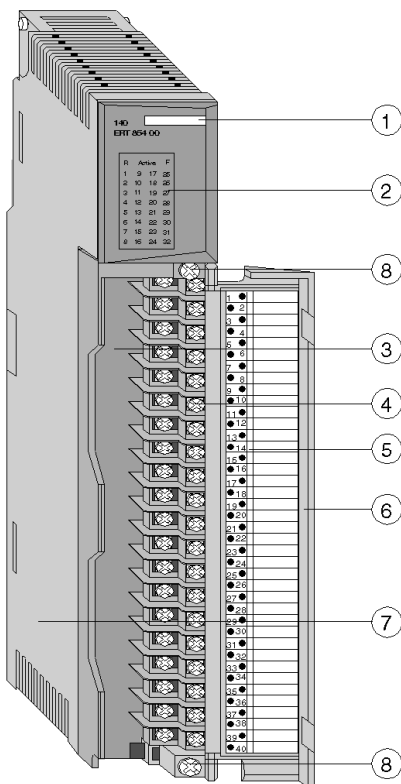
## Overview

### Introduction

The 140 ERT 854 10 is a Quantum Expert Module with 32 binary inputs (24 ... 125 VDC). The module is suitable for the evaluation of digital inputs, counter pulses and events.

### Front View of the Module

Front View of the ERT 854 10



**Location of Operating Elements**

- 1 Color Code
- 2 Display field (LEDs)
- 3 Terminal Block
- 4 Connection terminals
- 5 Sliding Label (inside)
- 6 Cover for the terminal blocks
- 7 Standard housing
- 8 Screws for terminal block

**NOTE:** The tightening torque must be between 0.5 Nm and 0.8 Nm.

***NOTICE*****DESTRUCTION OF ADAPTER**

- Before tightening the locknut to the torque 0.50...0.80 Nm, be sure to properly position the right-angle F adapter connector.
- During tightening, be sure to maintain the connector securely.
- Do not tighten the right-angle F adapter beyond the specified torque.

**Failure to follow these instructions can result in equipment damage.**

## Features and Functions

### Features

The ERT 854 10 is a Quantum Expert Module with 2 groups of 16 binary inputs (24...125 VDC). The input groups are potentially isolated to each other and to the internal logic. In addition to counted values, discrete inputs can be registered with or without event logging. A digital time standard (DTS) receiver can be connected for time synchronization.

**NOTE:** The reference input voltage must be identical to the input voltage level.

### Mode of Functioning

The registers of the ERT 854 10 count impulses with frequencies of up to 500 Hz with an interruption/impulse period of 1 ms and provide these values as 32 bit counter values for the CPU. The module is logically divided into 4 blocks of 8 inputs. The inputs of each block can be processed as binary input signals, event or counters, depending on the parameters set.

The input processing (debounce time, edge recognition and inversion) can be configured separately for each input.

The module supports DCF77 formatted time receivers over a 24 VDC input.



## Planning

### What is to be planned

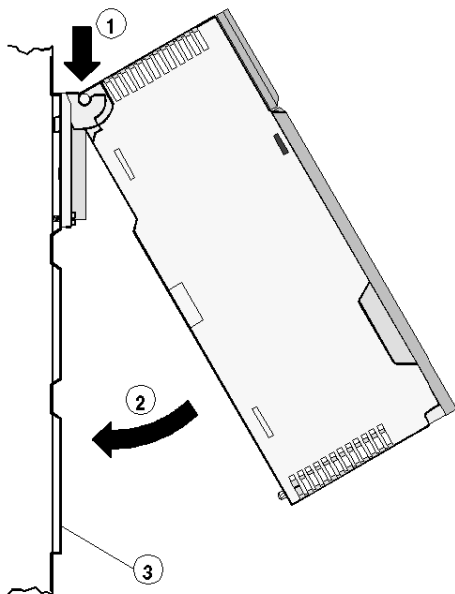
You plan:

- a slot in the Quantum rack (local or RIO station).
- the ERT Parameters. Each of the 4 ERT 854 10 input function block can be configured with a different functionality (e.g. counters or inputs with or without event recording).
- the connection of the reference voltage for each input group.
- the Process Peripherals Connection.
- the connection of an external time receiver.

### Mounting Position in the Rack

Insert the module in any I/O slot on the Quantum and screw it to the rack. The module must be screwed into position to ensure correct operation (EMC).

Mounting the Module



- 1 Insert the module
- 2 Screw the module to the rack
- 3 Rack

## Module Cabling

### Overview

This section describes the connection of time receivers, reference voltages and external input signals.

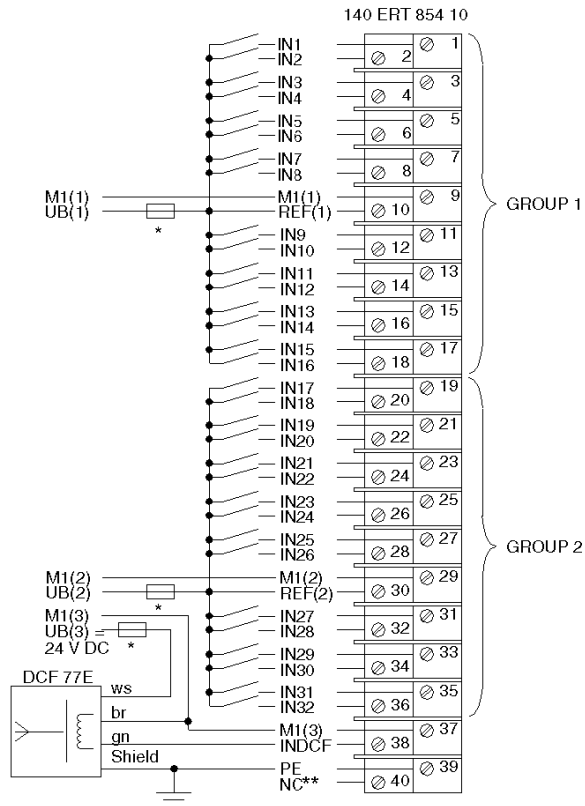
### Reference Voltage

The input voltage range for the inputs is defined with the reference voltage. Reference voltages and input signals of the same group are to be protected with a common fuse. In addition, the inputs can also be individually protected.

|   |
|---|
| <b><i>NOTICE</i></b>  |
| <b>MODULE DAMAGE</b><br>Never use the ERT module without a proper reference voltage to avoid damage to the module.<br><b>Failure to follow these instructions can result in equipment damage.</b> |

**DCF 77E**

Connection example for the ERT 854 10 with a DCF 77E time receiver



\* UB(1), UB(2): 24 ... 125 VDC, UB(3): 24 VDC, separate protection recommended

\*\* not connected, suitable for support clamp for UB(3)

**NOTE:** The tightening torque must be between 0.5 Nm and 0.8 Nm.

## **NOTICE**

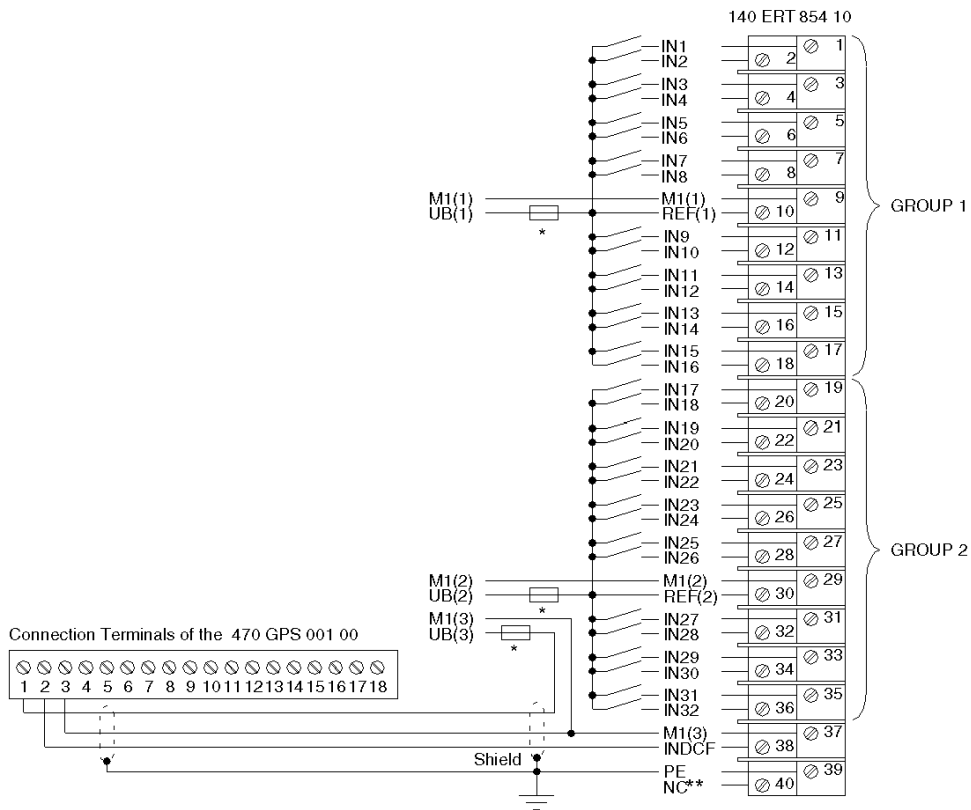
### **DESTRUCTION OF ADAPTER**

- Before tightening the locknut to the torque 0.50...0.80 Nm, be sure to properly position the right-angle F adapter connector.
- During tightening, be sure to maintain the connector securely.
- Do not tighten the right-angle F adapter beyond the specified torque.

**Failure to follow these instructions can result in equipment damage.**

**GPS 001**

Connection example for the ERT 854 10 with a GPS 001 time receiver



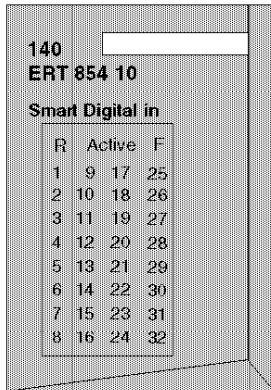
\* UB(1), UB(2):24 ... 125 VDC, UB(3): 24 VDC, separate protection recommended

\*\* not connected, suitable for support clamp for UB(3)

## Diagnosis

### Condition Display

The modules have the following indicators:



Meaning of the Indicators:

| Indicators: | Color | Meaning   |
|-------------|-------|---|
| R           | green | Ready. Self test successful when voltage connected. The firmware is running correctly and the module is ready for operations. |
| Active      | green | Bus communication is present.   |
| F           | red   | Module Error. Lights when the configured error occurs.  |
| 1 ... 32    | green | Input Signal. Indicator for process input signal "1".   |

## Technical data

### Supply

#### Data of the Supply

|  |   |
|--|---|
| Reference voltage for each process input group | 24 ... 125 VDC, (max. 18 ... 156 VDC) Current consumption per group: max. 20 mA |
| internal via the rack                          | 5 VDC, max. 300 mA  |
| Current requirements for buffer operation      | maximum 0.07 mA from XCP 900 00   |

### Process Inputs

#### Data of the Process Inputs

|   |  |              |              |             |
|---|--|--------------|--------------|-------------|
| Number  | 32 in 2 Groups   |              |              |             |
| Input Voltage   | 24 ... 125 VDC   |              |              |             |
| Potential isolation   | Inputs to the Quantum Bus, Group 1 to Group 2 (Opto-coupler)<br>1780 VAC for 1 minute  |              |              |             |
| Debounce time   | 0 ... 255 milliseconds (configurable)  |              |              |             |
| Inversion   | Set with parameters  |              |              |             |
| Max. Cable length   | 400 m unshielded, 600m shielded  |              |              |             |
| Switching Level:<br>Nominal voltage for the input signals<br>Min current for a 1 signal | 24V<br>6mA   | 48V<br>2.5mA | 60V<br>2.5mA | 125V<br>1mA |
| Signal level 0 signal<br>Signal level 1 signal  | nominal 0% of the group reference voltage,<br>max. +15 %, min. -5 %<br>nominal 100% of the group reference voltage,<br>max. 125 %, min. 75 % |              |              |             |
| Internal power loss from all process inputs   | max 7.5 W  |              |              |             |

**NOTE:** The reference input voltage must be identical to the input voltage level.

### Input for the time receiver

Data for the time receiver

|                       |                                     |
|-----------------------|-------------------------------------|
| Number                | 1, DCF77 Data format from DCF- 077E |
| Input Voltage         | 24 VDC                              |
| Potential isolation   | Optocoupler                         |
| Time Stamp resolution | 1 ms                                |
| Current consumption   | 5 mA                                |

### Mechanical structure

Dimensions and Weight

|               |                                     |
|---------------|-------------------------------------|
| Format        | Width = 40.34 mm (Standard Housing) |
| Mass (weight) | 0.45 kg                             |

### Connection Type

Data of the Connections

|                              |                        |
|------------------------------|------------------------|
| Process Inputs, DCF receiver | 40 pins Terminal Block |
|------------------------------|------------------------|

### Environmental conditions

Data of the Environmental Conditions

|             |                         |
|-------------|-------------------------|
| System Data | See Quantum User Manual |
| Power loss  | Max. 9W, typical 5W     |





---

# Part III

## Configuration

---

### Overview

The 140 ERT 854 10 is included in Control Expert as a standard module. This section describes the configuration of the modules and the parameterization of the corresponding EFBs. An example is given for the most important applications.

### What Is in This Part?

This part contains the following chapters:

| Chapter | Chapter Name                           | Page |
|---------|--|------|
| 6       | Quantum Addressing Modes               | 43   |
| 7       | The Parameter Configuration Window     | 49   |
| 8       | Startup the 140 ERT 854 10             | 55   |
| 9       | Integration in the Application Program | 63   |
| 10      | EFBs for the 140 ERT 854 10            | 67   |



---

# Chapter 6

## Quantum Addressing Modes

---

### Overview

In the functional description of this expert module, the %IW/%MW (3x/4x) register addressing mode established in the Quantum world is widely used. This chapter describes the different modes used in Control Expert to address the data from a Quantum module.

**NOTE:** Topological addresses overlapping (%IW<sub>r</sub>.m.c) is not supported by Quantum application, use flat addressing (%IW<sub>x</sub>) when memory overlapping control is needed.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic   | Page |
|---|------|
| Flat Addressing—800 Series I/O Modules                            | 44   |
| Topological Addressing—800 Series I/O Modules with Control Expert | 45   |
| Addressing Example  | 46   |
| Discrete I/O Bit Numbering  | 47   |
| Addressing  | 48   |

## Flat Addressing—800 Series I/O Modules

### Introduction

800 series I/O modules follow a system of flat address mapping in Control Expert. To work properly, each module requires a determinate number of bits and/or words. The IEC addressing system is equivalent to the 984LL register addressing. Use the following assignments:

- 0x is now %Mx
- 1x is now %Ix
- 3x is now %IWx
- 4x is now %MWx

The following table shows the relationship between 984LL notation and IEC notation.

| Outputs and Inputs | 984LL Notation Register Addresses | IEC Notation          |                  |               |
|--------------------|-----------------------------------|-----------------------|------------------|---------------|
|                    |                                   | System Bits and Words | Memory Addresses | I/O Addresses |
| output             | 0x                                | System Bit            | %Mx              | %Qx           |
| input              | 1x                                | System Bit            | %Ix              | %Ix           |
| input              | 3x                                | System Word           | %IWx             | %IWx          |
| output             | 4x                                | System Word           | %MWx             | %QWx          |

To access the I/O data of a module,

| Step | Action   |
|------|--|
| 1    | Enter the address range in the configuration screen. |

### Examples

The following examples show the relationship between 984LL register addressing and IEC addressing:

000001 is now %M1

100101 is now %I101

301024 is now %IW1024

400010 is now %MW10

## Topological Addressing—800 Series I/O Modules with Control Expert

### Accessing I/O Data Values

Use topological addressing to access I/O data items. Identify the topological location of the module within an 800 series I/O module with Control Expert using the following notation:

```
%<Exchangetype><Objecttype>[\b.e\]r.m.c[.rank]
```

where:

- **b** = bus
- **e** = equipment (drop)
- **r** = rack
- **m** = module slot
- **c** = channel

**NOTE:** When addressing,

1. The [b.e] defaults to \1.1\ in a local rack and does not need to be specified.
2. The rank is an index used to identify different properties of an object with the same data type (value, warning level, error level).
3. The rank numbering is zero-based, and if the rank is zero, omit the entry.

For detailed information on I/O variables, please refer to the *EcoStruxure™ Control Expert, Program Languages and Structure, Reference Manual*.

### Reading Values: An Example

| To read   | Action                     |
|---|----------------------------|
| input value (rank = 0) from channel 7 of an analog module located in slot 6 of a local rack:          | Enter<br>%IW1.6.7[.0]      |
| input value (rank = 0) from channel 7 of an analog module located in slot 6 of drop 3 of RIO bus 2:   | Enter<br>%IW\2.3\1.6.7[.0] |
| 'out of range' value (rank = 1) from channel 7 of an analog module located in slot 6 of a local rack: | Enter<br>%I1.6.7.1[.0]     |

## Addressing Example

### Comparing the 3 Addressing Modes

The following example compares the 3 possible addressing modes. An 8-channel thermocouple 140 ATI 030 00 module with the following configuration data is used:

- mounted in slot 5 of the CPU rack (local rack)
- starting input address is 201 (input word %IW201)
- end input address is 210 (input word %IW210)

To access the I/O data from the module you can use the following syntax:

| Module data                 | Flat Addressing | Topological Addressing | IODDT Addressing             | Concept Addressing                             |
|-----------------------------|-----------------|------------------------|------------------------------|--|
| Channel 3 temperature       | %IW203          | %IW1.5.3               | My_Temp.VALUE                | 300203   |
| Channel 3 out of range      | %IW209.5        | %I1.5.3.1              | My_Temp.ERROR                | 300209<br>Bit 5 to be extracted by user logic  |
| Channel 3 range warning     | %IW209.13       | %I1.5.3.2              | My_Temp.WARNING              | 300209<br>Bit 13 to be extracted by user logic |
| Module internal temperature | %IW210          | %IW1.5.10              | not accessible through IODDT | 300210   |

**NOTE:** For the IODDT the data type `T_ANA_IN_VWE` is used and the variable `My_Temp` with the address `%CH1.5.10` was defined.

For comparison, the register addressing as used with Concept is added in the last column. As Concept does not support direct addressing of a bit in a word, the bit extraction has to be performed in the user program.

## Discrete I/O Bit Numbering

### Introduction

The numbering of channels of an I/O module usually starts with 1 and counts up to the maximum number of supported channels. The software however starts numbering with a 0 for the least significant bit in a word (LSB). The Quantum I/O modules have their lowest channel mapped to the most significant bit (MSB).

The following figure shows the mapping of I/O channels related to the bits in a word:.

|     |    |    |    |    |    |   |   |   |    |    |    |    |    |    |    |               |
|-----|----|----|----|----|----|---|---|---|----|----|----|----|----|----|----|---------------|
| 1   | 2  | 3  | 4  | 5  | 6  | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | I/O Channels  |
| 15  | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6  | 5  | 4  | 3  | 2  | 1  | 0  | Bit numbering |
| MSB |    |    |    |    |    |   |   |   |    |    |    |    |    |    |    | LSB           |

### Word Addressing Versus Bit Addressing

Mainly discrete I/O modules can be configured to deliver their I/O data either in word format or in bit format. This can be selected during configuration by selecting either `%IW` (`%MW`) or `%I` (`%M`). If you need to access a single bit from an I/O module configured to use an I/O word, you can use the syntax `%word.bit`. The following table gives you the connection between I/O point number and the associated I/O address in bit and word addressing.

The table shows a 32-point input module in the main rack, slot 4 configured with starting address `%I1` or `%IW1`:

| I/O channel | Bit address (flat addressing) | Bit address (topological addressing) | Bit address extracted from word (flat addressing) | Bit address extracted from word (topological addressing) |
|-------------|-------------------------------|--------------------------------------|---|--|
| 1           | <code>%I1</code>              | <code>%I1.4.1[.0]</code>             | <code>%IW1.15</code>                              | <code>%IW1.4.1.1.15</code>                               |
| 2           | <code>%I2</code>              | <code>%I1.4.2[.0]</code>             | <code>%IW1.14</code>                              | <code>%IW1.4.1.1.14</code>                               |
| 3           | <code>%I3</code>              | <code>%I1.4.3[.0]</code>             | <code>%IW1.13</code>                              | <code>%IW1.4.1.1.13</code>                               |
| ...         |                               |                                      |   |  |
| 15          | <code>%I15</code>             | <code>%I1.4.15[.0]</code>            | <code>%IW1.1</code>                               | <code>%IW1.4.1.1.1</code>                                |
| 16          | <code>%I16</code>             | <code>%I1.4.16[.0]</code>            | <code>%IW1.0</code>                               | <code>%IW1.4.1.1.0</code>                                |
| 17          | <code>%I17</code>             | <code>%I1.4.17[.0]</code>            | <code>%IW2.15</code>                              | <code>%IW1.4.1.2.15</code>                               |
| 18          | <code>%I18</code>             | <code>%I1.4.18[.0]</code>            | <code>%IW2.14</code>                              | <code>%IW1.4.1.2.14</code>                               |
| ...         |                               |                                      |   |  |
| 31          | <code>%I31</code>             | <code>%I1.4.31[.0]</code>            | <code>%IW2.1</code>                               | <code>%IW1.4.1.2.1</code>                                |
| 32          | <code>%I32</code>             | <code>%I1.4.32[.0]</code>            | <code>%IW2.0</code>                               | <code>%IW1.4.1.2.0</code>                                |

## Addressing

### Flat Addressing

This module requires 7 contiguous, 16-bit input words (%IW), and 5 contiguous, 16-bit output words (%QW).

### Topological Addressing

Topological addresses for the 140ERT85410 Time Stamp Module:

| Point    | I/O Object       | Comment |
|----------|------------------|---------|
| Input 1  | %IW[\b.e]r.m.1.1 | Data    |
|          | ...              |         |
| Input 7  | %IW[\b.e]r.m.1.7 | Data    |
| Output 1 | %QW[\b.e]r.m.1.1 | Data    |
|          | ...              |         |
| Output 5 | %QW[\b.e]r.m.1.5 | Data    |

Used abbreviations: **b** = bus, **e** = equipment (drop), **r** = rack, **m** = module slot.

### Note

The above described addressing is for information only. Direct access to the modules raw data is not recommended. All data exchange should be performed through the EFBs for the ERT module.



---

# Chapter 7

## The Parameter Configuration Window

---

### The Parameter Configuration Window

#### Call

You can access the Parameter Configuration window for the 140 ERT 854 10 module by double-clicking on a module in the Quantum rack.

You can also open the configuration window by clicking on the module with the right mouse button.

#### Structure of the Parameter Configuration Window

The Parameter Configuration window contains general parameters for the module and the specific parameters for the four function blocks.

The parameters have been preset to default values contained in the "I/O Image", and can be modified by the user.

Parameters can only be edited when the application program is not running.

### Parameters and Default Values

Structure of the Parameter Configuration window, general parameter

| Parameter Name         | Value                |
|------------------------|----------------------|
| MAPPING                | WORD (IW-3X)         |
| INPUT START ADDRESS    | 1                    |
| INPUT END ADDRESS      | 7                    |
| OUTPUT START ADDRESS   | 1                    |
| OUTPUT END ADDRESS     | 5                    |
| TASK                   | MAST                 |
| MODULE                 |                      |
| MODULE NUMBER          | 0                    |
| CLOCK                  | DCF/GPS-SYNC         |
| VALIDITY RESERVE       | 1                    |
| COMPLETE TIME REPORT   | Yes                  |
| WARM_RESTART           |                      |
| ENABLE_AS_ERROR        |                      |
| BLOCK1                 |                      |
| FUNCTION 1             | 1POINT WITH TIME TAG |
| DEBOUNCE FILTER TYPE 1 | STEADY STATE         |
| DECHATTERING 1         | No                   |
| INPUT1                 |                      |
| INPUT2                 |                      |
| INPUT3                 |                      |
| INPUT4                 |                      |
| INPUT5                 |                      |
| INPUT6                 |                      |
| INPUT7                 |                      |
| INPUT8                 |                      |
| BLOCK2                 |                      |
| BLOCK3                 |                      |
| BLOCK4                 |                      |

The following table provides an overview of the general module parameters and their default values.

| Name                       | Default Value       | Options | Meaning   |
|----------------------------|---------------------|---------|---|
| <b>MAPPING</b>             | <b>WORD (IW-3X)</b> | -       | The default value cannot be changed because the 140 ERT 854 10 module normally reads the raw values from the input words (%IW-3X) and writes them to the output words (%MW-4X). |
| <b>INPUT START ADDRESS</b> | <b>1</b>            | -       | Input starting address  |
| <b>INPUT END ADDRESS</b>   | <b>7</b>            | -       | The ending address for the inputs results from the starting address for the inputs plus 6 because the module occupies seven %IW registers.                                      |

| Name                  | Default Value | Options  | Meaning   |
|-----------------------|---------------|--|---|
| OUTPUT START ADDRESS  | 1             | -  | Output starting address   |
| OUTPUT END ADDRESS    | 5             | -  | The ending address for the outputs results from the starting address for the inputs plus 4 because the module occupies five %MW registers.  |
| TASK                  | MAST          | MAST/FAST(AUX0/AUX1/AUX2/AUX3 only with CPU 6** **, MAST only with a M580 CPU) | MAST = Master Task is assigned<br>FAST = Fast Task is assigned<br>AUX = AUX Task is assigned<br>The settings for MAST/ TASK/ AUX are defined during CPU configuration.  |
| <b>MODULE:</b>        |               |  |   |
| MODULE NUMBER         | 0             | 1...127  | User defined, inserted in event message. The uniqueness of the value is not checked. 0 = Default, no selection made   |
| CLOCK                 | DCF/GPS-SYNC  | DCF/GPS Clock  | External synchronization in DCF77 format by the DCF or GPS clock.   |
|                       |               | Internal clock   | Telegram synchronization. The clock runs either without monitoring or is monitored within a validity reserve.   |
|                       |               | No   | Internal clock is deactivated   |
| VALIDITY RESERVE      | 1 hour        | 1...254 hours  | Internal clock: Time from the last synchronization until setting the TU bits and the time until the time stamp becomes invalid.   |
|                       |               | 0  | Internal clock: 0 = free run mode without elapsed time (TE/TU bits are not set)   |
|                       |               | 1...5 hours  | DCF/GPS Clock: 1 hour recommended   |
| COMPLETE TIME REPORT  | Yes           | No/Yes   | Switches the transfer of the complete time telegram (with month and year) on or off. Transfer of the complete time report is made as dummy event 1x directly before a time stamp event: the prerequisite is always transferring a time stamp event for monthly transitions, every start/stop of user programs, clearing the time stamp buffer, starting/setting the clock, otherwise the complete time report telegram is not sent. |
| <b>WARM_RESTART:</b>  |               |  |   |
| CLEAR COUNTERS        | No            | No/Yes   | Clear counter on warm restart   |
| CLEAR TIME TAG BUFFER | No            | No/Yes   | Clear FIFO buffer on warm restart   |

| Name                    | Default Value | Options | Meaning  |
|-------------------------|---------------|---------|--|
| <b>ENABLE_AS_ERROR:</b> |               |         |  |
| DCF GPS FAULT           | No            | No/Yes  | Error values shown by the error LED "F".<br>The enabled bits are treated as errors.<br>Every disabled bit is treated as a warning<br>(the error bits for an error during a self test<br>are always set). |
| TIME INVALID            | Yes           | No/Yes  |  |
| TIME NOT SYNCHRONIZED   | No            | No/Yes  |  |
| BUFFER OVERRUN          | Yes           | No/Yes  |  |

Structure of the Parameter Configuration window, specific parameters for the four function blocks

| Overview                 |                      | Configuration | I/O objects |
|--------------------------|----------------------|---------------|-------------|
| Parameter Name           | Value                |               |             |
| — MAPPING                | WORD (W-3x)          |               |             |
| — INPUT START ADDRESS    | 1                    |               |             |
| — INPUT END ADDRESS      | 7                    |               |             |
| — OUTPUT START ADDRESS   | 1                    |               |             |
| — OUTPUT END ADDRESS     | 5                    |               |             |
| — TASK                   | MAST                 |               |             |
| ⊕ MODULE                 |                      |               |             |
| ⊖ BLOCK1                 |                      |               |             |
| — FUNCTION 1             | 1POINT WITH TIME TAG |               |             |
| — DEBOUNCE FILTER TYPE 1 | STEADY STATE         |               |             |
| — DECHATTERING 1         | No                   |               |             |
| ⊖ INPUT1                 |                      |               |             |
| — DISABLE 1              | No                   |               |             |
| — INVERT 1               | No                   |               |             |
| — BOTH EDGES 1           | Yes                  |               |             |
| — DEBOUNCE TIME 1        | 1                    |               |             |
| — CHATTERING COUNT 1     |                      |               |             |
| — CHATTERING TIME 1      |                      |               |             |
| ⊕ INPUT2                 |                      |               |             |
| ⊕ INPUT3                 |                      |               |             |
| ⊕ INPUT4                 |                      |               |             |
| ⊕ INPUT5                 |                      |               |             |
| ⊕ INPUT6                 |                      |               |             |
| ⊕ INPUT7                 |                      |               |             |
| ⊕ INPUT8                 |                      |               |             |
| ⊕ BLOCK2                 |                      |               |             |
| ⊕ BLOCK3                 |                      |               |             |
| ⊕ BLOCK4                 |                      |               |             |

The following table provides an overview of the specific parameters for the four function blocks and their default values. The parameters can be set individually for each block.

| Name                 | Default value         | Options                  | Meaning                                |
|----------------------|-----------------------|--------------------------|--|
| BLOCK                | 1...4                 | 1...4                    | Number of the selected function block. |
| FUNCTION             | 1 POINT WITH TIME TAG | DISCRETE                 | Only binary inputs                     |
|                      |                       | COUNTER                  | Binary and counter values              |
|                      |                       | 1 POINT WITH TIME TAG    | Binary + 1 bit event logging           |
|                      |                       | 2 POINT WITH TIME TAG    | Binary + 2 bit event logging           |
|                      |                       | 8 POINT WITH TIME TAG    | Binary + 8 bit event logging           |
| DEBOUNCE FILTER TYPE | STEADY STATE          | STEADY STATE/INTEGRATING | Debounce filter mode                   |
| DECHATTERING         | No                    | No/Yes                   | Disabling/enabling the chatter filter  |

The following parameters refer to all individual inputs (**Exception:** Chatter time refers to two inputs next to each other)

| Name             | Default value | Options                         | Meaning   |
|------------------|---------------|---------------------------------|---|
| INPUT            | 1...32        | 1...8, 9...16, 17...24, 25...32 | Input number sequence for the function block selected   |
| DISABLE          | No            | No/Yes                          | Impedes processing of input data for the input (always 0)   |
| INVERT           | No            | No/Yes                          | Reverse polarity of the input   |
| BOTH EDGES       | Yes           | No/Yes                          | Edge monitoring for both edges  |
| DEBOUNCE TIME    | 1             | 0...255                         | Debounce time 0... 255 milliseconds<br>0 = without internal SW delay  |
| CHATTERING COUNT | 0             | 0...255                         | Chatter number 0... 255 (for event/counter inputs)<br>0 = Chatter filter deactivated                                    |
| CHATTERING TIME  | 1             | 1...255                         | Chatter filter time duration 1... 255*0.1 seconds<br><b>Note:</b> This setting refers to two inputs next to each other! |

### I/O Object

The %IW/%MW (3x/4x) register addressing mode established in the Quantum range is also used for 140 ERT 854 10. It reads the raw values from the input words (%IW-3x) and writes them to the output words (%MW-4x).



---

# Chapter 8

## Startup the 140 ERT 854 10

---

### Overview

This chapter describes the preconditions and boundary conditions required for starting the 140 ERT 854 10 and provides a check list with the necessary steps.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic   | Page |
|---|------|
| 140 ERT 854 10 Module and Resource Limitations          | 56   |
| DCF Receiver  | 57   |
| The GPS Receiver  | 58   |
| Behaviour when starting/restarting and the data storage | 59   |
| Check List  | 61   |

## 140 ERT 854 10 Module and Resource Limitations

### Limitations

Check whether the following conditions have been adhered to before starting the configuration:

- Can be used in local or remote racks (RIO) with RIO Drop Firmware higher than V1
- Cannot be used in DIO Drops
- Up to 9 ERTs can be mounted on each remote (RIO) drop
- Processing signal status > 1 millisecond + filter time possible
- Counter inputs up to 500Hz with 32 bit
- Each ERT requires an "ERT\_854\_10" transfer EFB
- 7 INPUT words, 5 OUTPUT words per ERT
- Several ERT modules can be connected to one standard time receiver. The 140 ERT 854 10 requires 5 mA from the receiver
- Maximum power consumption of 0.07mA from the battery module XCP 900 00 required for receiving counter, event FIFO buffer and parameter data.

### Time receiver

The standard time receiver must provide an output signal in DCF77 format for 24 VDC.

The following standard time receivers are provided:

- DCF77E: DCF long wave receiver for Europe



---

## DCF Receiver

### Overview

The DCF 77E module operates as an internal receiver with integrated antennae.

The module receives and converts the received time signal in a 24 VDC signal in DCF77 format, and amplifies it before sending it on to the 140 ERT 854 10 module.

### DCF Signal

The time signal received in the Central European Time zone is known as the DCF77 and provides CET. It is sent from the atomic clock to the National Institute for Science and Technology Braunschweig, Germany, and sends a long wave signal of 77.5 kHz (from which DCF77 derives its name) via a transmitter in Frankfurt am Main. The signal can be received throughout Europe (in a radius of approximately 1000 km from Frankfurt).

When selecting a location for erecting an antennae, the following sources of interference should be taken into account which could disturb or destroy signal reception through their DCF receivers:

- electromagnetically contaminated areas. Avoid areas with potential sources of interference, such as strong transmitters, switching stations and airports. Strong interference can also be caused by industrial machinery and cranes.
- Steel supports in buildings, rooms and apartments. Poor reception can occur in cellars, underground car parks and closed operating cabinets.
- "Shadows" and "dead band" in mountain areas, high buildings, ...

## The GPS Receiver

### Overview

GPS standard time receivers can be used as long as they deliver the time signal in DCF77 format with a 24 VDC potential.

### GPS Signal

A group of lower orbiting GPS satellites (Global Positioning System) send radio signals from which extensive time information can be derived. Their orbits are distributed evenly so that every point on earth is covered by at least 3 different satellites. The GPS signal can be received across the whole world. The absolute time precision achieved by the GPS signal is considerably higher than that reached by the DCF receiver.

GPS satellites send UTC time (Universal Time Coordinated) which corresponds to GMT (Greenwich Mean Time). Seconds and years transitions are taken into account.

Calendar and day data is diverted from the GPS signal and transferred to the 140 ERT 854 10 module.

The antenna must be ordered separately from the GPS receiver. More details are contained in the technical data section of your receiver.

When selecting a location for erecting an antenna, the following sources of interference should be taken into account which could disturb or destroy signal reception through their GPS receivers:

- electromagnetically contaminated areas: Avoid areas with potential sources of interference, such as strong transmitters, switching stations and airports.
- limited to the sky and the horizon: The antenna must be erected outside to ensure disturbance operation. Enclosed spaces or operating cabinets impede satellite reception.
- Length of the antenna cable: Do not exceed the maximum permitted length of the antenna cable
- Atmospheric conditions: Heavy snowfall and rain can impede your GPS receiver or even prevent any signal reception.

---

## Behaviour when starting/restarting and the data storage

### Cold Start

This is the default behavior of the ERT when connecting or reconnecting a stable power supply.

- All recorded events, counter values and the current parameters of the ERT are initialized with a defined state.
- The recording of the process data is delayed until the PLC has been started and can therefore provide the ERT with a valid parameter set.
- Since the ERT does not have a hardware clock, the internal software clock is invalid until it has been synchronized in a suitable form:
  - Depending on the source which has been configured for time synchronization, the time stamps for all recorded events are set to invalid time until either: the internal clock is set with a DPM\_Time value using the EFB or time synchronization with an external time signal has occurred.
  - A special case: If the "clock" parameter of the ERT was configured as an "internal clock" in free running mode (with a validity reserve of zero), the internal clock starts with a default setting at hour 0 on 1/1/1990.
- If a "complete time report" has been configured, a complete time transfer is done directly before the first recorded event so that the clock synchronization follows.

### Data Storage

The current data of the ERT 854 10 can be protected from a power loss if the rack has a 140 XCP 900 00 battery module. If the supply voltage falls below a defined limit, it will be recognized by the rack. All recorded data, counter values and the current parameter set are saved in a non-volatile RAM by the firmware and remain until the next warm start (see below). In situations where the saving in the ERT does not happen (5 VDC short circuit or hot swap of the ERT module), a cold start is performed.

## Warm Start

Reconnecting a stable supply voltage causes a warm start of the ERT module, as long as the module is in a state where it can store the current data in a consistent form.

- All recorded events, counter values and the current parameters of the ERT are restored from the non-volatile RAM.
- If the "warm start" parameters ("Clear counter"/"clear message buffer") are configured, the recorded events and/or counter values are erased.
- Recording of the process data with the ERT is immediately continued with the same parameter set even if the PLC is not started yet or the remote connection could not be restored at this time.
- Since the ERT does not have a hardware clock, the software clock is invalid until it has been synchronized in a suitable form:
  - Depending on the source which has been configured for time synchronization, the time stamps for all recorded events are set to invalid time until either: the internal clock is set with a DPM\_Time value using the EFB or time synchronization with an external time signal has occurred.
  - A special case: If the "clock" parameter of the ERT was configured as an "internal clock" in free running mode (with a validity reserve of zero), the internal clock starts with a default setting at hour 0 on 1/1/1990.
- If a "complete time report" has been configured, a complete time transfer is done directly before the first recorded event so that the clock synchronization follows.
- If the corresponding "ERT\_854\_10" transfer EFB is active in the PLC again, the transfer of the events and counter values in the FIFO buffer of the ERT is continued. Current binary input values and status words are also transferred.
- If the PLC provides a new parameter set when starting which would mean a change in the time of process data evaluation, all recorded events and counter values are cleared since they would no longer be consistent with the new parameter set.

## Check List

### Step by Step

The following steps are to be performed for successfully start-up of the 140 ERT 854 10:

| Step | Action  |
|------|---|
| 1    | Install the 140 ERT 854 10 module in the local or remote rack.  |
| 2    | Connect the designated process peripherals and the standard time receiver to the module (see <i>Module Cabling</i> , page 34).  |
| 3    | Do not forget to connect the reference supply voltage for the ERT input groups.<br><b>Note:</b> Please ensure that the installation guidelines for the antennas for the standard time receiver are followed.  |
| 4    | Enter the 140 ERT 854 10 in the I/O map.<br><b>Note:</b> Take special note that the module requires seven %IW registers and five %MW registers in state RAM.  |
| 5    | Configure the 140 ERT 854 10 in the corresponding Parameter Configuration window to provide the required functionality (see <i>The Parameter Configuration Window</i> , page 49).   |
| 6    | Use the correct EFB from the I/O management function block library (Quantum I/O configuration family) to provide the "slot" input parameter for the "ERT_854_10" transfer EFB. either QUANTUM for local and DROP for remote module racks (see <i>DROP: Configuring an I/O station rack</i> , page 68 or <i>QUANTUM: Configuring a main rack</i> , page 71).   |
| 7    | Define EFB user data structures for the required data types. Events can be "used", for example, by outputting them to a printer or storing them in central data storage.  |
| 8    | Use the "ERT_854_10" transfer EFB from the I/O management function block library (Expert I/O module family) to transfer ERT data (see <i>ERT_854_10: Data transfer EFB</i> , page 74).<br><b>Note:</b> The transfer of new events with the "ERT_854_10" EFB overwrites the previous event information. Therefore the user confirmation should only be provided when the data has been completely evaluated and is no longer needed. |
| 9    | Please note the difference in the behavior of the ERT when starting/restarting depending on if the rack has an XCP module (see <i>Behaviour when starting/restarting and the data storage</i> , page 59).   |



---

# Chapter 9

## Integration in the Application Program

---

### Overview

The chapter contains information about how the ERT 854 10 module and respective EFBs are inserted in the Control Expert application program.

### What Is in This Chapter?

This chapter contains the following topics:

| Topic                               | Page |
|-------------------------------------|------|
| Integrating Intelligent I/O Modules | 64   |
| Configuration Section               | 65   |
| Processing Section                  | 66   |

## Integrating Intelligent I/O Modules

### Introduction

EFBs are provided for integrating intelligent I/O modules. The EFBs are designed so that the program can be created as independently as possible from the hardware module used. The project specific information is processed and stored in data structures on the PLC using hardware dependent EFBs (e.g. ERT\_854\_10). The ERT\_854\_10 data transfer EFB works with these data structures. It reads the raw values from the Input words (%IWx), processes them and writes the ERT handshake and clock synchronization data to the output words (%MWx). The result of this is that changes of direct addresses or changes of the input or output parameters are automatically evaluated by the EFBs.

### Dividing into sections

Since the evaluation of the configured data is only done once after loading, it is recommended that the EFBs for linking to intelligent modules are divided into several sections.

A division into at least two sections is recommended.

- Configuration section
- Processing section

By division into a configuration section and several processing sections, the CPU load can be reduced because the configuration section only has to be executed once (after a restart or a warm start). The processing section must usually be executed continuously.

The configuration section is controlled with the EN inputs of the corresponding EFB. The EFBs are enabled with internal variables that are set to 1 in the first cycle.



## Configuration Section

### Configuration section

The configuration section is used to configure the analog input and output modules and controls data exchange between the analog EFBs, the State Ram and the configuration data.

The configuration section should be called `CfgErt` and the internal variable which controls it should be called `CfgErtDone` to guarantee the compatibility to future Control Expert versions.

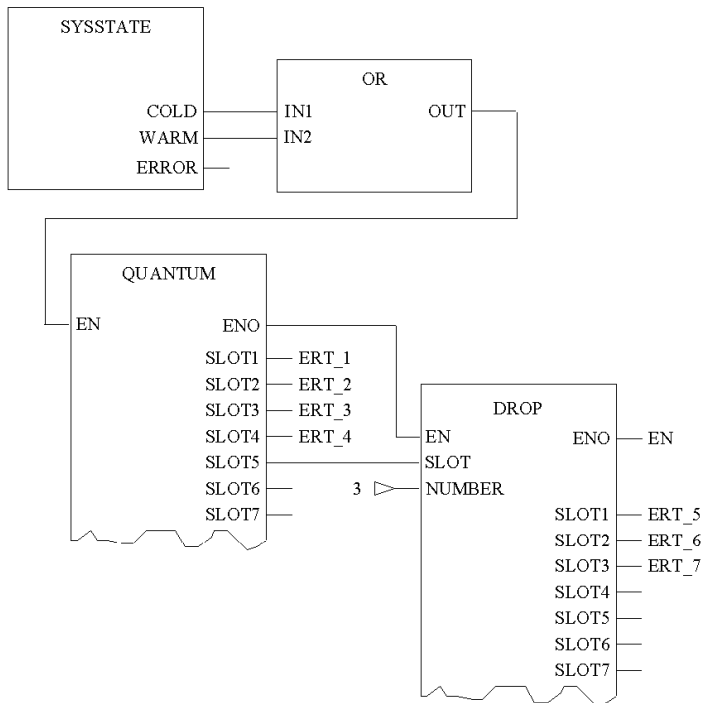
There are 2 possibilities for the control of the configuration sections:

- using the `EN` inputs of the individual EFBs
- enabling or disabling the configuration section.

### Controlling the Configuration Section

Control of the configuration section is possible through the `EN` inputs of this section's individual EFBs. The EFBs are enabled through the `SYSSTATE` EFB which has `COLD` or `WARM` outputs that are set to 1 for one cycle after either a cold or a warmstart.

Example of a `CfgErt` configuration section



## Processing Section

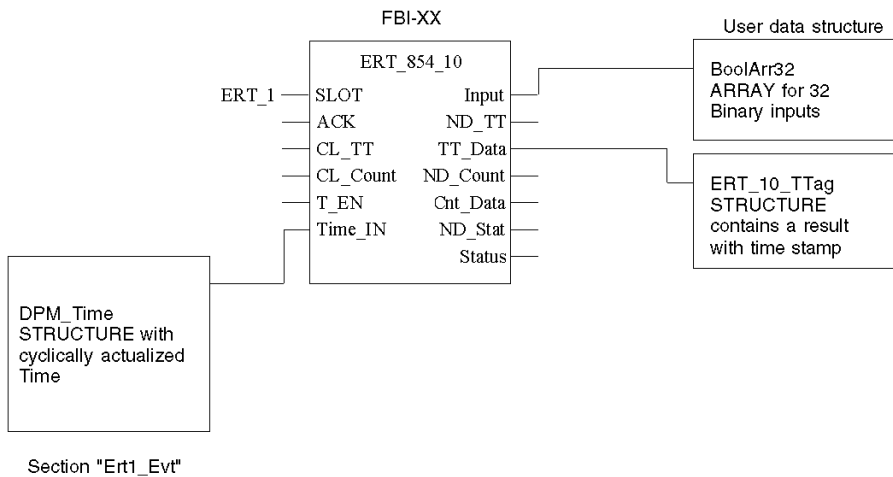
### Processing section

The processing section for actual data processing of the ERT\_854\_10 EFBs.

### Example

The following example of a processing section uses the parameter "slot" for its ERT\_854\_10 EFB which can be taken from a QUANTUM or a DROP EFB. (See also *Configuration Section, page 65.*)

Typical implementation of an ERT\_854\_10 EFB in the processing section



---

# Chapter 10

## EFBs for the 140 ERT 854 10

---

### Overview

The EFBs described in this chapter are required for operating the 140 ERT 854 10.

### What Is in This Chapter?

This chapter contains the following sections:

| Section | Topic                                 | Page |
|---------|---------------------------------------|------|
| 10.1    | DROP: Configuring an I/O station rack | 68   |
| 10.2    | QUANTUM: Configuring a main rack      | 71   |
| 10.3    | ERT_854_10: Data transfer EFB         | 74   |

## Section 10.1

### DROP: Configuring an I/O station rack

#### Description

##### Function description

The function block is used to edit the configuration data of a remote or distributed I/O station for subsequent processing by module configuration EFCs.

To configure an I/O station rack, the `DROP` function block in the configuration section is connected to the corresponding `SLOT` output of the `QUANTUM` function block. The number of the I/O station defined in the I/O map has to be entered at the `NUMBER` input of the `DROP` function block. The function blocks for configuration of the analog modules of the I/O stations are connected to the `SLOT` outputs.

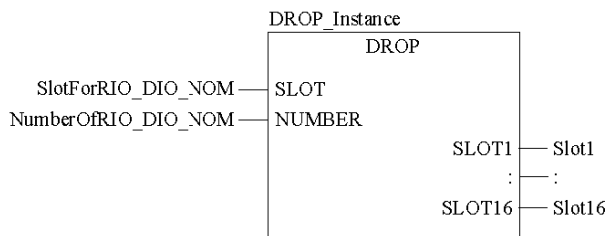
**NOTE:** Do not specify Literals at the `SLOT` inputs of the configuration EFCs. `SLOT` inputs must be connected to `SLOT` outputs. Values in `SLOT` outputs are not supposed to be used directly by the user. They refer to configuration areas in the PLC memory associated to the configured modules. Invalid values will cause a runtime error message in menu **Tools** → **Diagnostic Viewer**.

**NOTE:** In a M580 application with Quantum drops, `SLOT` input is left unconnected because the `QUANTUM` function block is not used.

`EN` and `ENO` can be configured as additional parameters.

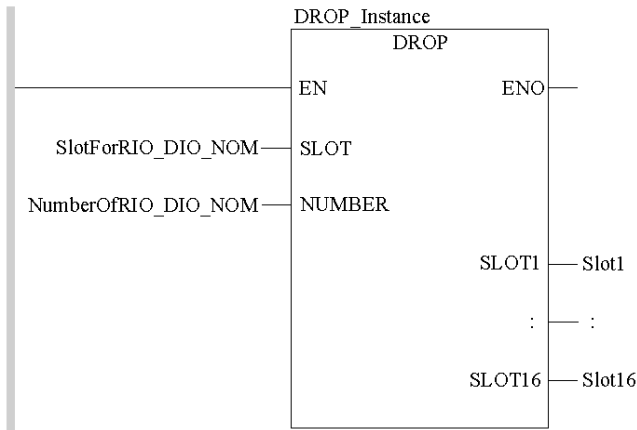
##### Representation in FBD

Representation:



### Representation in LD

Representation:



### Representation in IL

Representation:

```

CAL DROP_Instance (SLOT:=SlotForRIO_DIO_NOM,
NUMBER:=NumberOfRIO_DIO_NOM, SLOT1=>Slot1,
SLOT2=>Slot2, SLOT3=>Slot3, SLOT4=>Slot4, SLOT5=>Slot5,
SLOT6=>Slot6, SLOT7=>Slot7, SLOT8=>Slot8, SLOT9=>Slot9,
SLOT10=>Slot10, SLOT11=>Slot11, SLOT12=>Slot12,
SLOT13=>Slot13, SLOT14=>Slot14, SLOT15=>Slot15,
SLOT16=>Slot16)
    
```

### Representation in ST

Representation:

```

DROP_Instance (SLOT:=SlotForRIO_DIO_NOM,
NUMBER:=NumberOfRIO_DIO_NOM, SLOT1=>Slot1,
SLOT2=>Slot2, SLOT3=>Slot3, SLOT4=>Slot4, SLOT5=>Slot5,
SLOT6=>Slot6, SLOT7=>Slot7, SLOT8=>Slot8, SLOT9=>Slot9,
SLOT10=>Slot10, SLOT11=>Slot11, SLOT12=>Slot12,
SLOT13=>Slot13, SLOT14=>Slot14, SLOT15=>Slot15,
SLOT16=>Slot16) ;
    
```

### Parameter description

Description of input parameters:

| Parameter | Data type | Meaning                 |
|-----------|-----------|-------------------------|
| SLOT      | INT       | Slot for RIO, DIO, NOM  |
| NUMBER    | DINT      | Number of RIO, DIO, NOM |

Description of output parameters:

| Parameter | Data type | Meaning |
|-----------|-----------|---------|
| SLOT1     | INT       | Slot 1  |
| :         | :         | :       |
| SLOT16    | INT       | Slot 16 |

### Runtime error

If no "Head" has been configured for the I/O station rack, an error message is returned.

**NOTE:** For a list of all block error codes and values, refer to the Tables of Error Codes for the IO Management Library (see *EcoStruxure™ Control Expert, I/O Management, Block Library*).

---

## Section 10.2

### QUANTUM: Configuring a main rack

---

#### Description

##### Function description

The function block is used to edit the configuration data of a QUANTUM main rack for subsequent use by the scaling EFBs.

To configure a Quantum main rack, the QUANTUM function block is inserted into the configuration section. The function blocks for the configuration of analog modules or the DROP function block for the I/O station are connected at its SLOT outputs.

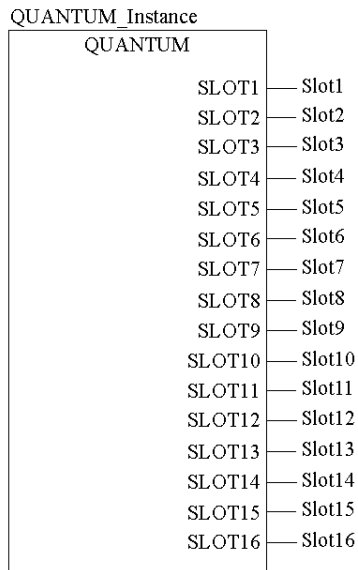
**NOTE:** Do not specify Literals at the SLOT inputs of the configuration EFBs. SLOT inputs must be connected to SLOT outputs. Values in SLOT outputs are not supposed to be used directly by the user. They refer to configuration areas in the PLC memory associated to the configured modules. Invalid values will cause a runtime error message in menu **Tools → Diagnostic Viewer**.

**NOTE:** In a M580 application with Quantum drops, QUANTUM function block is not used. DROP function block is used alone without connecting its SLOT input.

EN and ENO can be configured as additional parameters.

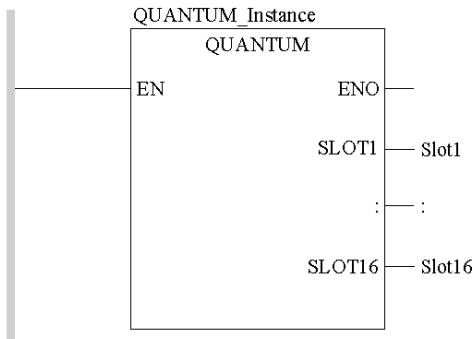
### Representation in FBD

Representation:



### Representation in LD

Representation:





## Representation in IL

Representation:

```
CAL QUANTUM_Instance (SLOT1=>Slot1, SLOT2=>Slot2,
  SLOT3=>Slot3, SLOT4=>Slot4, SLOT5=>Slot5, SLOT6=>Slot6,
  SLOT7=>Slot7, SLOT8=>Slot8, SLOT9=>Slot9,
  SLOT10=>Slot10, SLOT11=>Slot11, SLOT12=>Slot12,
  SLOT13=>Slot13, SLOT14=>Slot14, SLOT15=>Slot15,
  SLOT16=>Slot16)
```

## Representation in ST

Representation:

```
QUANTUM_Instance (SLOT1=>Slot1, SLOT2=>Slot2,
  SLOT3=>Slot3, SLOT4=>Slot4, SLOT5=>Slot5, SLOT6=>Slot6,
  SLOT7=>Slot7, SLOT8=>Slot8, SLOT9=>Slot9,
  SLOT10=>Slot10, SLOT11=>Slot11, SLOT12=>Slot12,
  SLOT13=>Slot13, SLOT14=>Slot14, SLOT15=>Slot15,
  SLOT16=>Slot16) ;
```

## Parameter description

Description of output parameters:

| Parameter | Data type | Meaning |
|-----------|-----------|---------|
| SLOT1     | INT       | Slot 1  |
| :         | :         | :       |
| SLOT16    | INT       | Slot 16 |

## Runtime error

Internal I/O map errors will cause an error message.

**NOTE:** For a list of all block error codes and values, refer to Tables of Error Codes for the IO Management Library (*see EcoStruxure™ Control Expert, I/O Management, Block Library*).

# Section 10.3

## ERT\_854\_10: Data transfer EFB

---

### Introduction

This chapter describes the `ERT_854_10` block.

### What Is in This Section?

This section contains the following topics:

| Topic  | Page |
|--|------|
| Description  | 75   |
| Function mode  | 80   |
| EFB configuration  | 82   |
| Data Flow  | 83   |
| Other Functions  | 88   |
| Use of the <code>DPM_Time</code> structure for the synchronization of the internal ERT clock | 89   |
| Using the ERT >EFB Time Data Flow  | 90   |

## Description

### Function Description

The `ERT_854_10` EFB provides the programmer with a software interface to the ERT 854 10 module which allows simple access of the functions such as counting, time stamp, status or time synchronization. The `ERT_854_10` EFB coordinates the flow of Multiplex data from the ERT to the PLC using the input and output registers. It also ensures that the intermediate count values are put in an internal storage area until the data is complete, so a consistent set of all count values is made available to the statement list. A marker "New data" is always set for every data type if the input data type in the corresponding EFB output structure was copied.

As additional parameters, `EN` and `ENO` can be configured.

### Inconsistency between EFB Output and %IW Data

In general the `%IW` data correspond to the EFB output pin named `INPUT`.

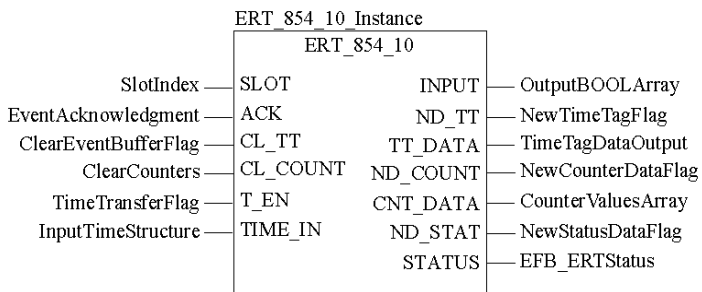
It should be taken into account that this EFB output is inconsistent to the `%IW` data for a few scans after starting PLC, because of the implemented handshake mechanisms in communication between the `ERT_854_10` EFB and the ERT hardware.

**NOTE:** In case the EFB reports any communication error the `%IW` data are not updated by the ERT hardware.

This means you must not use `%IW` data if the EFB reports a problem by returning `ENO = false`.

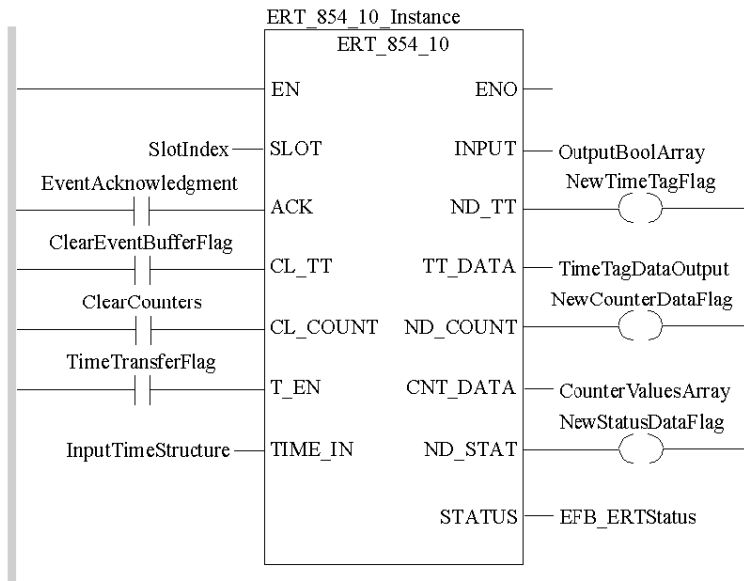
### Appearance in FBD

Representation:



### Appearance in LD

Representation:



### Appearance in IL

Appearance :

```

CAL ERT_854_10_Instance (SLOT:=SlotIndex,
    ACK:=EventAcknowledgment, CL_TT:=ClearEventBufferFlag,
    CL_COUNT:=ClearCounters, T_EN:=TimeTransferFlag,
    TIME_IN:=InputTimeStructure, INPUT=>OutputBoolArray,
    ND_TT=>NewTimeTagFlag, TT_DATA=>TimeTagDataOutput,
    ND_COUNT=>NewCounterDataFlag,
    CNT_DATA=>CounterValuesArray,
    ND_STAT=>NewStatusDataFlag, STATUS=>EFB_ERTStatus)
    
```

## Appearance in ST

Appearance :

```
ERT_854_10_Instance (SLOT:=SlotIndex,
  ACK:=EventAcknowledgment, CL_TT:=ClearEventBufferFlag,
  CL_COUNT:=ClearCounters, T_EN:=TimeTransferFlag,
  TIME_IN:=InputTimeStructure, INPUT=>OutputBoolArray,
  ND_TT=>NewTimeTagFlag, TT_DATA=>TimeTagDataOutput,
  ND_COUNT=>NewCounterDataFlag,
  CNT_DATA=>CounterValuesArray,
  ND_STAT=>NewStatusDataFlag, STATUS=>EFB_ERTStatus) ;
```

## Parameter Description

Description of the input parameters:

| Parameter | Data type | Meaning  |
|-----------|-----------|--|
| SLOT      | INT       | The Slot index is assigned to the EFB ERT_854_10 from either the QUANTUM or DROP EFB and contains the configured input and output references (%IW und %MW)                       |
| ACK       | BOOL      | Event confirmation: Setting ACK signals that the user is ready to receive the next event and deletes the TT_DATA marker. If ACK remains set, "Continuous operation" is executed. |
| CL_TT     | BOOL      | Delete the ERT event FIFO buffer by setting CL_TT. Storage of events is blocked until CL_TT is reset to 0.   |
| CL_COUNT  | BOOL      | Clears all ERT counters by setting CL_COUNT. Counting is interrupted until CL_COUNT is reset to 0.   |
| T_EN      | BOOL      | Enables a time transfer, e.g. from the ESI using TIME_IN, if set   |
| TIME_IN   | DPM_Time  | Structure of the ESI, e.g. input time through time synchronization of the ERT (carries the edge controlled time synchronization in the Sync element)                             |

Description of output parameters:

| Parameter | Data type   | Meaning   |
|-----------|-------------|---|
| INPUT     | BOOLArr32   | Output array for all 32 digital inputs in <code>BOOL</code> format (also provided in the form of word references as <code>%IWx</code> and <code>%IWx+1</code> ) |
| ND_TT     | BOOL        | Marker, new data in <code>TT_DATA</code> structure: remains set until acknowledged by the user with <code>ACK</code>  |
| TT_DATA   | ERT_10_TTag | Event message output structure with time stamp. An event is held and <code>ND_TT</code> is set to 1 until acknowledged by the user with <code>ACK = 1</code> .  |
| ND_COUNT  | BOOL        | Marker, new counter data in <code>CNT_DATA</code> structure: The value 1 is set for only one cycle and is not acknowledged.                                     |
| CNT_DATA  | UDIntArr32  | Output array for 32 counter values (is overwritten after the EFB has received a complete set of consistent counter values (configured as: 8, 16, 24, or 32).    |
| ND_STAT   | BOOL        | Marker; new status data in <code>STATUS</code> word: The value 1 is set for only one cycle and is not acknowledged.   |
| STATUS    | WORD        | Output word for EFB/ERT status (for internal details see <i>Data Flow, page 83</i> )  |

### Internal Time Synchronization

Structure of `DPM_Time` for ERT internal time synchronization, e.g. through the ESI:

| Element | Element type | Meaning   |
|---------|--------------|---|
| Sync    | BOOL         | Clock synchronization with positive edge (hourly or on command) |
| Ms_Lsb  | BYTE         | Time in milliseconds (least significant byte)                   |
| Ms_Msb  | BYTE         | Time in milliseconds (most significant byte)                    |
| Min     | BYTE         | Invalid time / minutes  |
| Hour    | BYTE         | Summer time / hours   |
| Day     | BYTE         | Week day / day of month   |
| Mon     | BYTE         | Month   |
| Year    | BYTE         | Year  |

## Event Structure

Event structure of the ERT\_10\_TTag with 5 Byte time markers (more information can be found in *Data Flow, page 83*):

| Element | Element type | Meaning                                       |
|---------|--------------|---|
| User    | BYTE         | Complete time / user number [module number]   |
| INPUT   | BYTE         | Event set type / No. of the first input       |
| In      | BYTE         | Event data: 1, 2 or 8 scheduled positions     |
| Ms_Lsb  | BYTE         | Time in milliseconds (least significant byte) |
| Ms_Msb  | BYTE         | Time in milliseconds (most significant byte)  |
| Min     | BYTE         | Invalid time / minutes                        |
| Hour    | BYTE         | Summer time / hours                           |
| Day     | BYTE         | Weekday / Day of the month:                   |

## Function mode

### ERT data transfer

The number of I/O words available on the S908 remote drops is limited to 64 inputs and 64 outputs. For this reason the number of settable ERT modules per remote drop with the currently selected minimum requirements of 7 input words and 5 output words is limited to 9.

The size of the required ERT data transfer is considerably larger:

- 32 counters = 64 words,
- a event with a 5 byte time marker = 4 words,
- 32 digital values and the ERT status = 3 words.

These inconsistent size requirements necessitate the use of a special transfer EFB called `ERT_854_10` to execute the required operations on the PLC and to adjust the ERT representation of the data in Multiplex form. This type of EFB is required for every ERT module.

To simplify matters, configure only the EFB parameters which will actually be used. This saves on configuration, particularly when the counter inputs and event inputs get mixed with one another. Memory is not saved because Control Expert fills the outputs with invisible.

### Underlying structure of the register block

Underlying structure of the `ERT_854_10` input register block with seven %IW input words for transfer from the ERT to the PLC:

| Contents                 | Function   |
|--------------------------|--|
| Digital inputs 1 ... 16  | Digitally processed input data which is cyclically updated (the module's input address corresponds to that of the digital standard input modules, i.e. inputs 1 16 correspond to bits 15 0)                                  |
| Digital inputs 17 ... 32 |  |
| Transfer status          | IN transfer status (TS_IN)   |
| MUX 1                    | Multiplex data block for block transfer, such as: <ul style="list-style-type: none"> <li>● 1 event with 5 byte time marker or</li> <li>● 2 counter values of maximal configuration 32 or</li> <li>● 1 status word</li> </ul> |
| MUX 2                    |  |
| MUX 3                    |  |
| MUX 4                    |  |

Simplified structure of the `ERT_854_10` output register block with five %MW output words for the transfer from the PLC to the ERT



ERT\_854\_10 output register block:

| Contents        | Function  |
|-----------------|---|
| Transfer status | OUT transfer status (TS_OUT)                              |
| MUX 1           | Time data block for the ERT for the clock synchronization |
| MUX 2           |   |
| MUX 3           |   |
| MUX 4           |   |

**NOTE:** User interfaces are normally the inputs and outputs of the ERT\_854\_10 EFB, not the %IW and %MW input/output words.

## EFB configuration

### EFB connection

The EFB connection to the input and output references (%IW and %QW) is accomplished through a graphic connection to the ERT slot number, in the same way as with analog modules. The currently available `QUANTUM` and `DROP` EFBs from the I/O Management library are used as follows: `QUANTUM` for local and `DROP` for remote racks. These EFBs transfer an integer index to every specified slot, which points to an internal data structure with the configured values. The module parameters and the ID are stored there, in addition to the addresses and lengths of the assigned input and output references (%IW and %MW).

A significant improvement in the runtime can be achieved by deactivating the `QUANTUM` or the `DROP` EFB after the first execution.

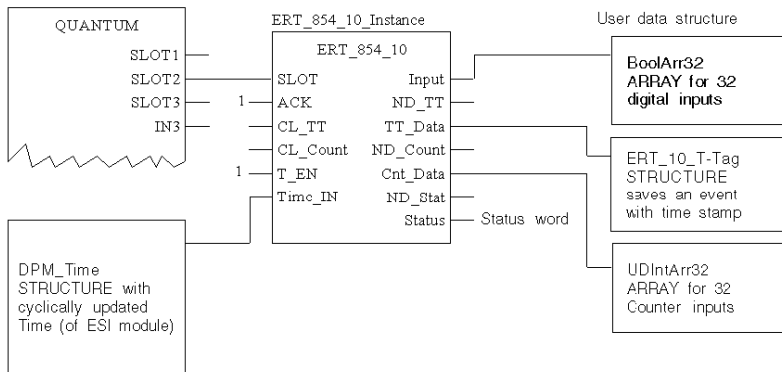
### Function of `CL_TT` and `CL_COUNT`

Setting the input marker `CL_TT` causes the FIFO buffer event of the ERT to be cleared. Setting the markers for one cycle is sufficient.

Setting the input marker `CL_COUNT` causes the ERT counter to be cleared by the ERT. Setting the markers for one cycle is sufficient.

## Block diagram

### Principle structure



---

## Data Flow

### Digital Inputs

No marker for new data is provided for this input type. The digital inputs in the first two input register words are updated directly by the ERT in every PLC cycle. The EFB makes the processed values available as Bool if the `BoolArr32` output field has been configured accordingly.

### Counter Inputs

Cyclic updating of the counted values lasts significantly longer than for other data types. Counted values are saved as a data set in `CNT_DATA` after a complete series (configured as: 8, 16, or 32) of time consistent counted values in multiplex form has been transferred by the ERT. The marker for new data `ND_COUNT` is set for one cycle.

### Event Inputs

Readiness to receive new events must be actively confirmed by the user, therefore the administration of markers becomes somewhat more complex (a handshake mechanism is required) Event data remain in the data structure `ERT_10_TTag` and the marker for new data `ND_TT` stays set until the `ACK` input is set and a new event thus requested. The EFB responds to this by resetting `ND_TT` for at least one cycle. After the new event has been sent to the `ERT_10_TTag` structure (marker structure), `ND_TT` is reset by the EFB. To prevent the new event data from being overwritten attention must be paid to fundamentally resetting the `ACK` input after the EFB has reset the `ND_TT` marker. This state can then remain stable to allow the user program enough time for event processing. Each subsequent event tracked with the ERT is temporarily stored within the event FIFO buffer.

New events are sent directly from the internal buffer of the EFB in intervals of at least 2 cycles for as long as the `ACK` input is set (for the special continuous operating mode); the effect is, however, that the `ND_TT` only stays set for one cycle. In this special mode the user program's task is still to terminate event processing before `ND_TT` signals the transfer of other new events to the `ERT_10_TTag` structure as handshake protection by `ACK` is not available in this case.

**ERT\_10\_TTag**

ERT\_10\_TTag event structure with 5 byte time marks

| Byte | Bits   | Function  |
|------|--|---|
| 1    | D0...D6 = Module no.<br>0...127<br>D7 = CT                   | Rough time: CT = 1 indicates that this time mark contains the whole time declaration including month and year in bytes 2 + 3. The Module no. can be set in any way in the parameter screen. |
| 2    | D0D5 = input no.<br>D6 = P1<br>D7 = P2                       | No. of the first input of the event group: 1...32<br>Type of the event message (P2, P1). 1..0.3 see <i>Note 1</i> ; <i>page 84</i><br>[Month value with CT = 1]                             |
| 3    | D0D7 = data from the event group (D7D0 with right alignment) | 1, 2 or 8 managed positions<br>[year value, if CT = 1]  |
| 4    | Time in milliseconds (low value byte)                        | 0 ... 59999 milliseconds (max. 61100) see <i>Note 2</i> ; <i>page 85</i> and <i>Note 3</i> ; <i>page 85</i>   |
| 5    | Time in milliseconds (high value byte)                       |   |
| 6    | D0...D5 = minutes<br>D6 = R<br>D7 = TI                       | Minutes: 0...59<br>Time invalid: TI = 1 means invalid time / reserved = 0 see <i>Note 3</i> ; <i>page 85</i>  |
| 7    | D0...D4 = hours<br>D5 = R<br>D6 = R<br>D7 = DS               | Hours: 0...23<br>Summer time: DS = 1 indicates that summer time is set<br>With shift SZ -> WZ has hour 2A and id SZ, and hour 2B has id WZ  |
| 8    | D0...D4 = DOM<br>D5...D7 = DOW                               | Day of the Month: 1 ... 31<br>Day of Week: Mon ... Sun = 1 ... 7<br>The day of week corresponds to CET thus it deviates from the standard used in the US (Sun = 1).                         |

**Note 1:**

Interpretation for byte 2

| D7 D6 | Type of event message | D5...D0        | No. of the first input of the event group |
|-------|-----------------------|----------------|---|
| 0 1   | 1 pin message         | 1 ... 32       | Input pin number                          |
| 1 0   | 2 pin message         | 1, 3, 5, ...31 | First input of the group                  |
| 1 1   | 8 pin message         | 1, 9, 17, 25   | First input of the group                  |

**Note 2:**

The value for the milliseconds is a maximum of 61100 ms with switch seconds (61000 plus a tolerance of 100 milliseconds)

**Note 3:**

For time markers containing an invalid time ( $T1 = 1$ ), the time in milliseconds is set to FFFF HEX. Minutes, hours and DOW/DOM values are invalid (i.e. undefined).

**Rough time declaration**

If the "rough time declaration" has been activated during the ERT configuration, the transfer of the complete time (with month/year) is executed in the following conditions: when the month changes, after the module restarts, during every start or stop of the PLC user program, when the event FIFO buffer is deleted, when the clock is started or set. If this rough time declaration is sent without the data input values, "triggering" basically takes place through a correct time stamped event. If this does not happen the values remain "stuck" in the ERT until an event occurs. Within the time mark of a "rough time declaration", the CT bit is always set so that byte 2 contains the information about the month, byte 3 the information about the year and bytes 4 to 8 display the same time mark values of the triggered event whose event message appears immediately after the rough time declaration.

**Status Inputs**

The marker for new status data `ND_STAT` is set for one cycle. The status inputs can be overwritten after 2 inquiry cycles.

The status word contains EFB and ERT error bits

**Division of the Error Bits**

Internal structure of the EFB/ERT status word:

| EFB error bits |     |     |     |     | ERT error bits |    |    |    |    |    |    |    |    |    |    |
|----------------|-----|-----|-----|-----|----------------|----|----|----|----|----|----|----|----|----|----|
| D15            | D14 | D13 | D12 | D11 | D10            | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |

## ERT Error Bits

D8 ... D0 ERT error bits

| Bit | Brief designation | Meaning   |
|-----|-------------------|---|
| D0  | FW                | Firmware errors, self test errors within internal memories (severe module errors)   |
| D1  | FP                | Parameterization errors (severe internal errors)  |
| D2  | TE                | External time reference error (time-basis signal disrupted or not present)  |
| D3  | TU                | Time became invalid   |
| D4  | TA                | Time is not synchronized (Free run mode, permanent run without time error message, see also: <i>Without power reserve</i> , <a href="#">page 89</a> ) |
| D5  | PF                | FIFO buffer overrun (loss of the most recent event data)  |
| D6  | PH                | FIFO buffer half full   |
| D7  | DC                | Stabilize active (some event data lost)   |
| D8  | CE                | ERT communication errors (procedure errors or time out)   |

When configuring the parameter screen some of these errors can be assigned to grouped error messages with the "F" light as well as the module's error byte within the status table. All other errors are then defined as warnings.

D11 ... D9 reserved

## EFB Error Bits

D15 ... D12 EFB error bits:

| Bin.         | Hex   | Meaning   |
|--------------|-------|---|
| 1001         | 9 HEX | wrong answer recognized, command (EFB internal error)       |
| 1000         | 8 HEX | EFB communication time out                                  |
| 0101         | 5 HEX | Wrong slot  |
| 0110         | 6 HEX | Health status bit is not set (ERT appears as not available) |
| Other values |       | Internal error  |

## Online error display

The following ERT/EFB error messages are displayed in the **Tools → Diagnostic Display** window with an error number and explanation.

EFB error messages:

| Message | Error         | Meaning   |
|---------|---------------|---|
| -30210  | User error 11 | communication time out occurred                               |
| -30211  | User error 12 | wrong answer recognized, synchronization (EFB internal error) |
| -30212  | User error 13 | wrong packet number detected (EFB internal error)             |
| -30213  | User error 14 | wrong field number detected (EFB internal error)              |
| -30214  | User error 15 | unexpected time tag (EFB internal error)                      |
| -30215  | User error 16 | wrong slot data (configuration check required)                |
| -30216  | User error 17 | health status bit is not set (ERT appears as not available)   |
| -30217  | User error 18 | EFB internal command buffer out of bounds                     |
| -30218  | User error 19 | wrong answer recognized, command (EFB internal error)         |
| -30219  | User error 20 | ERT error   |

ERT error messages:

| Message | Error        | Meaning                   |
|---------|--------------|---------------------------|
| -30200  | User error 1 | ERT internal error        |
| ...     | ...          | ...                       |
| -30203  | User error 4 | ERT internal error        |
| -30204  | User error 5 | ERT communication timeout |
| -30205  | User error 6 | ERT internal error        |
| ...     | ...          | ...                       |
| -30207  | User error 8 | ERT internal error        |

## Other Functions

### Input marker

Setting the input marker `CL_TT` deletes the Event FIFO buffer of the ERT. Setting the marker for one cycle is sufficient.

If the input marker `CL_Count` is set, the ERT counter is deleted by the EFB. Setting the marker for one cycle is sufficient.



## Use of the `DPM_Time` structure for the synchronization of the internal ERT clock

### Time synchronization

If the time cannot be synchronized through a standard time receiver, the time information can alternatively be transferred from the 140 ESI 062 01 communication module. The ESI makes the updated time available directly to the EFB in a `DPM_Time` structure via the `TIME_IN` parameter. The data structure can also be filled by the user program and the respective bits can be managed. In this way, for example, the time can be set by the CPU.

### With power reserve

As soon as the "clock" parameter of the ERT is configured as an "internal clock" with a power reserve not equal to zero (i.e. not free running) the EFB must use the time supplied by the ESI for the synchronization of the internal ERT clock. Until the first synchronization has taken place, the ERT sends back the set Bit "invalid time" in the `STATUS` output word (Bit 3 TU).

The conditions for the first synchronization of the internal ERT clock via the `DPM_Time` structure are:

The EFB Parameter `T_EN` must change from 0 to 1 to enable the time setting.

The time in `TIME_IN` made available by ESI must look as follows:

- valid (i.e. the bit for the message "time invalid" in `Min` value must not be set),
- and the values in `Ms` must change continually.

Should the time data later become invalid or no longer set, then the TU does not switch to 1 until the configured power reserve has expired.

The synchronization/setting of the internal ERT clock takes place via the `DPM_Time` structure, if:

- EFB-Parameter `T_EN` is set to 1 to enable the time setting.
- The time data in `TIME_IN` made available by ESI are valid (i.e. the "Time invalid" Bit in the `Min` value must not be set).
- The status of the `DPM_Time` element `Sync` changes from 0 to 1. This change is run every full hour by the 140 ESI 062 01 but can also be performed as the result of a suitable telecontrol command.

The precision of the time synchronized by the ESI at the ERT can be influenced by delays, by the PLC cycle time, as well as by the cumulative component, which reflects the differences in the ERT software clock (< 360 milliseconds/hour).

### Without power reserve

If the "clock" parameter of the ERT was configured as an "internal clock" in free running mode (with a power reserve of zero), the internal clock starts with a default setting at hour 0 on 1/1/1990. In this case the time can also be provided by using the `DPM_Time` data structure of the 140 ESI 062 01 module, as described above. As there is no power reserve available for use, the time will never be invalid and the Bit "Time not synchronized" within the `STATUS` output word (Bit 4 TA), given back by the EFB, is always set.

## Using the ERT >EFB Time Data Flow

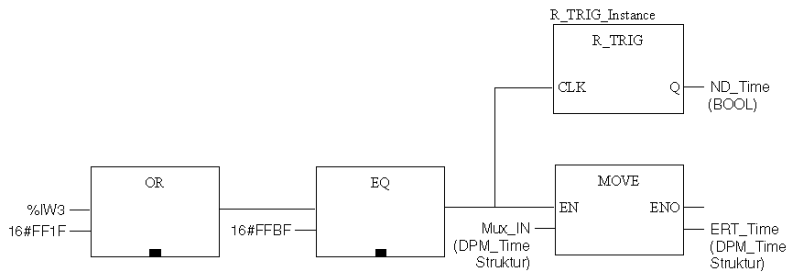
### Application examples

This section presents an internal function which is made available through the ERT for diagnostics and development. It covers the cyclic transfer of the ERT internal time to the corresponding EFB in greater intervals. This time application can be used to display or set the PLC clock etc, regardless of whether it comes from the free-running internal clock or was synchronized through an external reference clock signal. The time appears as a `DPM_Time` structure beginning with word 4 of the IN register block of the ERT. The following diagram shows the program elements involved in selection.

### Commissioning information

A `ERT_854_10` was assigned the IN references `%IW1 ... %IW3` during I/O addressing. The IN transfer status (`TS_IN`) in the third word of the register block is sent to an OR block. A `DPM_Time` structure is defined within the variable editor as Variable `Mux_IN` in the fourth word of the IN register block, and therefore has the address `%IW4 ... %IW7`. This variable is sent to the `MOVE` block as an entry. The `MOVE` block output is a `DPM_Time` structure defined by the variable editor as variable `ERT_Time`.

Typical recording mechanism for ERT time data



**NOTE:** The `ERT_854_10` EFB must be active and error free.

### Explanation:

The `MOVE` block transfers the time data cyclically stored in the MUX zone of the IN register block to the `DPM_Time` structure `ERT_Time` belonging to the user as soon as the OR and the EQ block signals a time data transfer. `R_TRIG` makes a signal in `ND_Time` available for further processing of the time data available for one cycle. The `BOOL Sync` element value of the `ERT_Time` should begin to "tick" during each new transfer from the ERT. There is a new transfer after a maximum of each 200 PLC cycles.



## 0-9

140ERT85410, *13*

## A

addressing  
flat, *43, 44*  
topological, *43*

## B

binary inputs, *15*  
bit order for discrete I/O, *43*

## C

cabling, *29*  
cold start, *55*  
counting values, *15*

## D

data storage, *55*  
debouncing, *15*  
dechattering, *15*  
default values, *49*

## E

event logging, *15*

## I

internal clock  
EFB synchronized, *23*  
IODDT, *67*

## M

mounting, *29, 33*

## P

processing sequence, *15*

## R

reference voltage, *29*

## T

time base  
DCF, *23*  
GPS, *23*

## W

warm start, *55*

