

Quantum

Clock Module 140 DCF 077 00

User manual

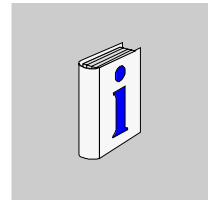
840 USE 470 00
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About the Book



At a Glance

Document Scope This manual describes the functionality and performance of the clock module 140 DCF 077 00 as well as its connection to the TSX Quantum. It is designed to show you how to provide your Quantum with real-time.

The following basic knowledge is required:

- Basic information on functionality, structure and configuration of the Quantum.
- Basic knowledge about programming Quantum using Concept

Validity Note The module is a Quantum module. It may be used with Concept Version 2.1 and higher. The assembly cannot be used with Modsoft.

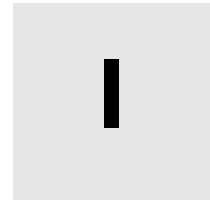
Related Documents

Title of Documentation	Reference Number
Concept User Manual	840 USE 503 02
Quantum Hardware User Manual	840 USE 100 02

You can download these technical publications and other technical information from our website at www.telemecanique.com

User Comments We welcome your comments about this document. You can reach us by e-mail at techpub@schneider-electric.com

Functionality



Overview

What can you find in this section?

This section contains a function description of the clock module.

What's in this Part?

This part contains the following chapters:

Chapter	Chapter Name	Page
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Functionality of the 140 DCF 077 00

1

Overview

Introduction

This chapter describes the functionality of the clock module 140 DCF 077 00.

What's in this Chapter?

This chapter contains the following topics:

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Overview for the implementation of the 140 DCF 077 00

Clock Module

The 140 DCF 077 00 clock module provides the TSX Quantum with the following clock and calendar data in real-time:

- Milliseconds, Minutes, Hours
- Weekday, Day of the month
- Month, Year

The real-time data is created from the GPS or DCF signal provided by an external time receiver. To operate the module you still require a time receiver with an antenna.

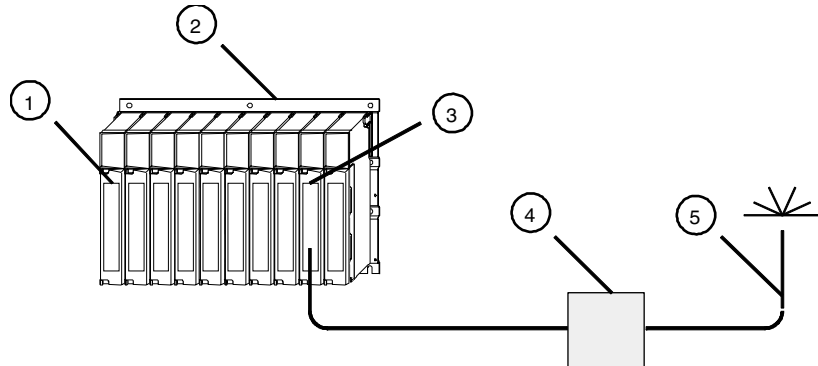
DCF Signal

The DCF signal sends CET (Central European Time). It is created by an atomic clock at the National Institute for Science and Technology in Braunschweig and transmitted using a long wave transmitter in Mainflingen (Frankfurt am Main).

GPS Signal

The GPS signal provides Greenwich mean time and is transmitted via GPS satellites.

TSX Quantum with 140 DCF 077 00 and time receiver



- 1 CPU
- 2 Quantum
- 3 140 DCF 077 00
- 4 Time receiver
- 5 Antenna

Several DCF modules can be connected to a time receiver. Refer to the time receiver data sheet for more detailed information.

Advantages of Real-time

This type of time recording (real-time) offers the following advantages over the time (system time) generated in the CPU.

Advantages	Description
Absolute Comparability	The time provided by the DCF module is synchronized externally from a global source and is identical throughout the entire reception area. There are no time differences between different systems (with the exception of time delays that are caused by signal processing in the individual modules). In comparison, the CPU generated system time is set manually and is then incremented by the CPU. This is CPU specific, time differences between different systems cannot be avoided.
Higher Accuracy	Time deviations caused by temperature variations or by the precision of the quartz are inapplicable as long as the synchronization by the time receiver can be guaranteed.
Time Offsets Compatible	The signal provided by the GPS or DCF receiver automatically takes leap seconds and leap years into consideration. Regional variations such as summer and winter time changes are also taken into consideration.

Scope of Application

The 140 DCF 077 has the following areas of application:

Application Examples	Description
Recording Events	You can record the occurrence of specific process states and messages with the time of the occurrence (= time stamping). This enables you to subsequently reconstruct when, and in what sequence, specific process signals "arrive" or "depart".
Periodic time stamping of process values	For recording counter and measurement values at defined intervals.
Time dependent switch handling	Time dependent outputs can be set for controlling lighting, heating, ventilators, temperatures (building automation), or for opening/closing doors, machines, ... (safety measures).

Method of Operation of the 140 DCF 077 00

Method of Operation

The module contains a software clock which counts the time in millisecond steps. This clock is synchronized in minute intervals using the external time signal from the receiver. In addition, the module checks the incoming time telegram for plausibility and corrects run errors in the software clock.

The real-time established in this way is placed in the PLC State RAM in 4 sequential word addresses (3x Register). The first address in the word area is set when entering the module in the I/O map.

Example for defining the start address of the word area

Address	High	Low
30001	ms Low	Sync (1 Bit)
30002	min	ms High
30003	day	hour
30004	year	mon

The clock and calendar data is placed in the CPU State RAM in 4 sequential word addresses (3x References). The format conforms to IEC 870-5-4. You can directly access each individually date using the derived data type DPM_TIME (See *Derived Data Types for 140 DCF 077 00, p. 16*).

After start-up, the module requires at least 3 minutes until it can deliver the time. If it receives invalid or no time telegrams at all during this time it will take that much longer.

Plausibility Test

With non-plausible or unusual time telegrams the software clock runs without synchronization (power reserve) until it is synchronized again by the next plausible telegram.

If the module receives no plausible telegram for 60 minutes, the invalid bit is set in the clock (bit 7 in the "min" element of the derived data type DPM_TIME (See *Derived Data Types for 140 DCF 077 00, p. 16*)). Time transfer to the PLC State RAM continues. The bit is reset as soon as the next valid time telegram is received.

Run Error Correction

The DCF module determines the mean deviation of the software clock from external clock signals using a defined time period and readjusts the software clock accordingly. This occurs constantly during the entire operating time of the 140 DCF 077 00. After a few hours of operating time (generally about 2-3 hours), the clock will then have reached its maximum accuracy range.

Functionality with DCF Receiver

DCF Transmitter The transmitter in this case is the DCF77 transmitter in Mainflingen (Frankfurt/am Main). It transmits Central European Time (CET) generated by the atomic clock in Braunschweig. Leap seconds and leap years are taken into account, as well as summer and winter time.

The transmitter transmits long wave signals with a frequency of 77.5 kHz. The reception area is central Europe.

DCF Receiver The DCF 77E module acts as the receiver. The antenna is integrated in the module. The module receives the time signal, demodulates it, amplifies it and passes it on to the 140 DCF 077 00 clock module.

Location Selection When selecting the location of the antenna, take into consideration the following types of disturbance that could affect or even destroy the reception performance of your DCF receiver:

Disturbance	Explanation/Counter measures
EMC affected location	Avoid locations in the vicinity of interference sources such as strong transmitters, switching stations and airports. Interference can also come from construction machinery and cranes.
Steel supports in buildings, rooms and apartments.	Poor reception can occur in cellars, underground car parks and closed operating cabinets.
Reception shadows	"Reception shadows" from mountains, large buildings, ...

Functionality with GPS Receiver

GPS Transmitter Numerous satellites act as transmitters that send the GPS signal. They are positioned in space so that every point of the earth's surface lies within a reception area covered by at least three satellites. The GPS signal can therefore be received across the whole world.

The satellites transmit UTC time (Greenwich mean time). Leap seconds and leap years are taken into account.

GPS Receiver The 470 GPS 001 00 module acts as the receiver. Other GPS receivers can also be used. However, they must transmit the GPS signal in DCF format with a level of 24 VDC.

The time and calendar information is evaluated from the GPS signal and passed on to the 140 DCF 077 00 module.

The GPS receiver requires a signal from three different satellites to make a correct evaluation. The 470 GPS 001 00 receiver converts the UTC information received from the satellites into the time required by the respective time zone (configurable using software) and takes special regulations such as summer/winter time into consideration.

The antenna must usually be ordered separately for GPS receivers. Refer to the information in the data sheet provided with your receiver for further details.

Note: When using the 470 GPS 001 00 you require the following components.

Components required for using the 470 GPS 001 00

Type	Description
470 GPS 001 00	GPS time receiver
470 GPA 001 00	GPS antenna
470 XCA 626 00	Antenna cable, pre-assembled (12 m)

**Location
Selection**

When selecting the location of the antenna, take into consideration the following types of disturbance that could affect or even destroy the reception performance of your GPS receiver:

Disturbance	Explanation/Counter measures
EMC affected location	Avoid locations in the vicinity of interference sources such as strong transmitters, switching stations and airports.
No clear view of the sky	Install the antenna in a clear open space. Enclosed spaces or switching cabinets impedes satellite reception.
Length of the antenna cable	Do not exceed the permitted length of the antenna cable of 12 m. (Antenna cable, pre-assembled, 12 m, type 470 XCA 626 00.
Weather	Heavy snow and rainfall can affect or knock out the reception of your receiver.
Cable length between GPS receiver and module	Depending on the load, DCF modules requires a minimum of 20 V.

Derived Data Types for 140 DCF 077 00

DPM_Time Data Type

The "DPM_Time" derived data type supports access to the time that the 140 DCF 077 00 module places in the TSX Quantum State RAM.

The 140 DCF 077 00 occupies the PLC 4 input words (3x References) in the State RAM. The first address in the word area is set when entering the module in the I/O map.

DPM_Time: Time stamp

Element	Data type	Meaning
sync	BOOL	Synchronization bit
ms	WORD	Milliseconds (0 ... 59999)
min	BYTE	Minutes. Time is invalid (not set or no time signal available for 60 mins), if bit 7 = 1.
hour	BYTE	Hours. Summer time, if bit 7 = 1.
day	BYTE	Day (weekday and day of month) Weekday (1, ..., 7, Monday = 1) in bit 5, 6 and 7 Day of Month (1, ..., 31) in other bits
mon	BYTE	Month
year	BYTE	Year

Module Descriptions



Overview

What can you find in this section?

This section contains a module description of the clock module.

What's in this Part?

This part contains the following chapters:

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140 DCF 077 00: Clock Module

2

Overview

Introduction

This chapter describes the clock module 140 DCF 077 00.

What's in this Chapter?

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Brief description

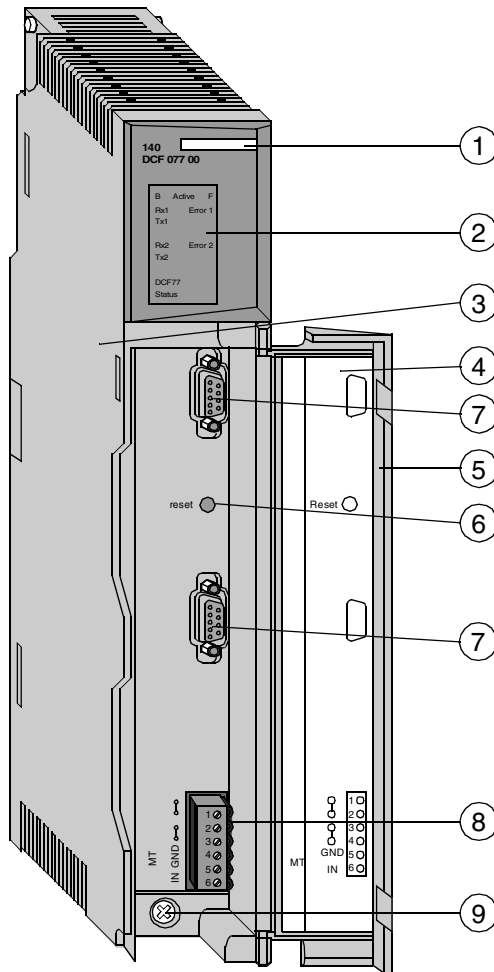
Features

The clock module 140 DCF 077 00 is used to connect a time receiver (GPS or DCF signal) to the TSX Quantum.

The module has a binary input for the time receiver and supplies this signal as real-time for the Quantum CPU.

Front View of the Module

Front view with positions of the operating elements



- 1 Color code
- 2 Display field (LEDs)
- 3 Standard housing
- 4 Sliding label (inside)
- 5 Removable cover
- 6 Reset button
- 7 Connector without function
- 8 Screw/plug-in terminal for supply and the time receiver (GPS or DCF)
- 9 Module assembly screw

**Function
description**

A hardware monoflop (Watchdog) with a run time of about 700 ms monitors the cycle of the internal processor. The respective LED "R" is lit as long as the internal processor functions correctly and 5 V is present. In response to the Watchdog, the LED is extinguished and CPU access to the Dual Port Memory is denied.

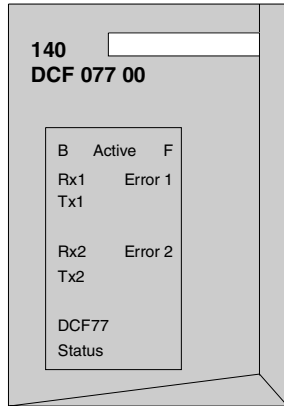
Standardization of the module is carried out as follows:

- Switch on the PLC (standardizes all module components)
 - Insert the module (standardizes all module components)
 - Press the Reset button (standardizes the processor)
 - Completion of the Watchdog monitoring time (standardizes the processor)
-

Description of the LEDs

Illustration of the Display

Representation of the Display



Explanation of the LEDs

Meaning of LEDs

LED	Color	Status	Meaning
R	green	On	Ready, module function
Active	green	On	Quantum bus communication
F	red	On	Error
Rx1	green	On	without function
Tx1	green	On	without function
Rx2	green	On	without function
Tx2	green	On	without function
DCF 77	green	Flashing	Time reception. Flashes in time with the input signal
Status	yellow	On	Status Lit when synchronization with the signal from the time receiver is achieved.
Error 1	red	On	Lit when no synchronization with the signal from the time receiver has not occurred for at least 60 minutes.
Error 2	red	On	Lit when no synchronization with the signal from the time receiver has been achieved.

Note: The time receiver is functioning correctly when the LED **DCF 77** flashes and the LED **Error 2** is extinguished.

Configuration

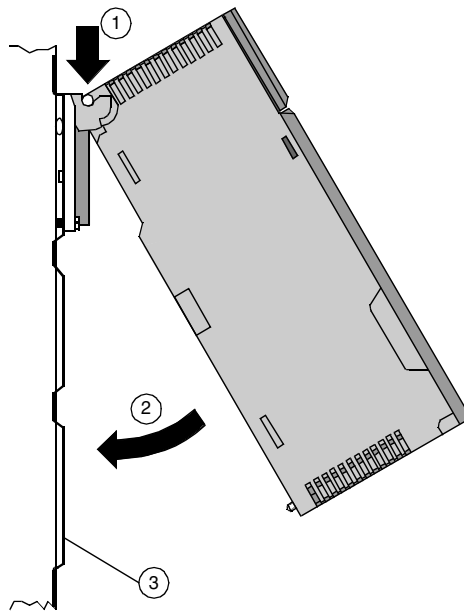
General information

Note: The two 9 pin D-type connectors on the front of the housing have no function.

Mounting Position on Rack

Insert the module in any I/O slot on the TSX 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 Module rack

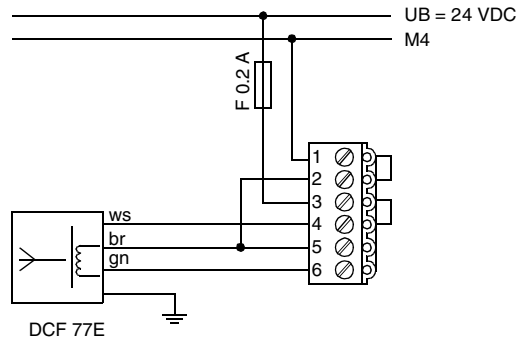
Connecting the Time Receiver

Connecting the time receiver interface to the 140 DCF 077 00

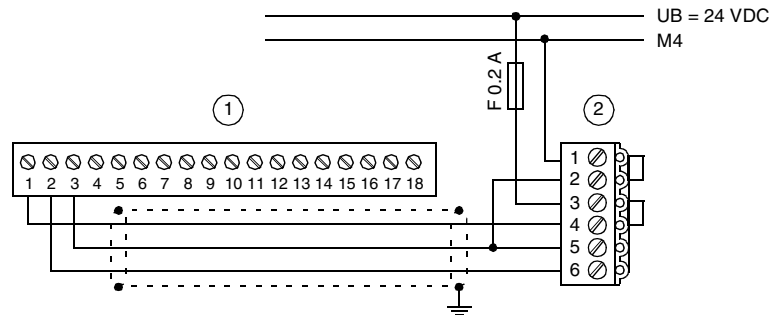
Terminal No.	Signal	Remarks
1	0V	bridged with terminal 2
2	0V	bridged with terminal 1
3	Supply voltage 24 VDC	bridged with terminal 4
4	Supply for external time receiver	bridged with terminal 3
5	0V	
6	Time signal from time receiver	

Note: Several clock modules can be connected to a time receiver. The 140 DCF 077 00 places a load on the time receiver of approximately 5 mA.

Connecting the Time Receiver DCF 77E to the terminal block of the 140 DCF 077 00



Connecting the Time Receiver 470 GPS 001 00



- 1 Connection terminals of the 470 GPS 001 00
- 2 Terminal blocks of the 140 DCF 077 00

Technical Data

Supply

Supply data

Externally for DCF Receiver	24 VDC, 30 mA max.
Internally via the system bus	5 VDC, 300 mA max.

DCF input

DCF input data

Number	1
Input voltage	24VDC
Potential isolation	Optocoupler

Processor

Processor data

Micro controller	80C32-25
Pulse frequency	22.1184 MHz

Memory

Memory data

RAM	256 KBytes for data and program, + 2 KB for DPM
Flash memory	128 KBytes for program and firmware

Mechanical structure

Mechanical construction data

Format	Width = 40.34 mm (Standard Housing)
Weight	0.45 kg

Connection method

Connection data

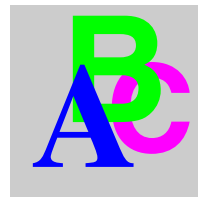
Time Receiver (GPS or DCF)	1 plug-in 6 pin screw/plug-in terminal
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Environmental conditions

Environmental conditions data

Power dissipation	max. 2 W
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