

## PowerXL™

### DG1 Variable Frequency Drives Real Time Clock and Use of the Timers



Level 2	<ul style="list-style-type: none"> <li>1 – Fundamental – No previous experience necessary</li> <li>2 – Basic – Basic knowledge recommended</li> <li>3 – Advanced – Reasonable knowledge required</li> <li>4 – Expert – Good experience recommended</li> </ul>
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Powering Business Worldwide

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## Danger! - Dangerous electrical voltage!

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Cover or enclose any adjacent live components.
- Follow the engineering instructions (AWA/IL) for the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE, PES) must be connected to the protective earth (PE) or the potential equalization. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference does not impair the automatic control functions.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that an open circuit on the signal side does not result in undefined states.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specification, otherwise this may cause malfunction and/or dangerous operation.
- Emergency stop devices complying with IEC/EN 60204-1 must be effective in all operating modes. Unlatching of the emergency-stop devices must not cause a restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been properly installed and with the housing closed.
- Wherever faults may cause injury or material damage, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (e.g. by means of separate limit switches, mechanical interlocks etc.).
- Frequency inverters may have hot surfaces during and immediately after operation.
- Removal of the required covers, improper installation or incorrect operation of motor or frequency inverter may destroy the device and may lead to serious injury or damage.
- The applicable national safety regulations and accident prevention recommendations must be applied to all work carried on live frequency inverters.
- The electrical installation must be carried out in accordance with the relevant electrical regulations (e. g. with regard to cable cross sections, fuses, PE).
- Transport, installation, commissioning and maintenance work must be carried out only by qualified personnel (IEC 60364, HD 384 and national occupational safety regulations).
- Installations containing frequency inverters must be provided with additional monitoring and protective devices in accordance with the applicable safety regulations. Modifications to the frequency inverters using the operating software are permitted.
- All covers and doors must be kept closed during operation.
- To reduce the hazards for people or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the frequency inverter (increased motor speed or sudden standstill of motor). These measures include: – Other independent devices for monitoring safety related variables (speed, travel, end positions etc.).
- Electrical or non-electrical system-wide measures (electrical or mechanical interlocks).
- Never touch live parts or cable connections of the frequency inverter after it has been disconnected from the power supply. Due to the charge in the capacitors, these parts may still be alive after disconnection. Consider appropriate warning signs.

## Disclaimer

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## 1 General

The devices of the series Power XL DG1 have a real time clock (RTC), which enables to amend status messages with a time stamp or to change operating conditions in a time controlled manner. This Application Note describes the handling of the battery, the setting of the RTC and the parameterization of time based actions.

## 2 The Battery

The battery is positioned behind the front cover of the device just below the keypad. The battery is mounted when receiving the drive from the factory. To prevent discharging during storage, the respective connection to the control board is unplugged.

Follow the procedure below to activate the battery:

- Remove the front cover of the drive.
- Insert the battery connector into the plug socket between the RJ45 port and the slot for the extension boards (see foto).
- Assemble the front cover



The parameter M43 „RTC Battery Status“ displays the status of the battery:

- 0: Not installed → No battery inside the drive or the battery connector is unplugged.
- 1: Installed → The battery is connected and in proper condition.
- 2: Change Battery → The charging status of the battery is too low. The battery must be exchanged.
- 3: Over Voltage → The voltage level of the battery is too high, e.g. because of using a wrong type of battery.

The replacement battery must be of the same type as the original one:

Supplier: Eaton, Type: DXG-ACC-RTBATT, Article No. 730-32039-00P

The response in case of a fault message because of a low charging level of the battery can be configured with P9.36 “Replace battery fault response”:

- 0: No response → A low charging level of the battery will be ignored.
- 1: Warning → No trip occurs. A warning message is generated, in case an output relay is configured accordingly.
- 2: Fault → The device trips. The behavior of the drive in case of battery fault depends on the setting of P7.10 “Stop Mode”. A fault message is generated, in case an output relay is configured accordingly.
- 3: Fault, Coast → The drive trips and the motor coasts to stop. A fault message is generated, in case an output relay is configured accordingly.

Parameter M42 „Latest Fault Code“ displays the fault, which occurred latest. The fault code for a battery fault („Exchange battery“) is „64“.

Parameter	Name	Range	Default
M42	Latest Fault Code	1...99 (64 in case of „Change Battery“)	-
M43	RTC Battery Status	0: Not installed 1: Installed 2: Change Battery 3: Over Voltage	0
P9.36	Replace Battery Fault Response	0: No response 1: Warning 2: Fault 3: Fault, Coast	1

### 3 The Real Time Clock (RTC)

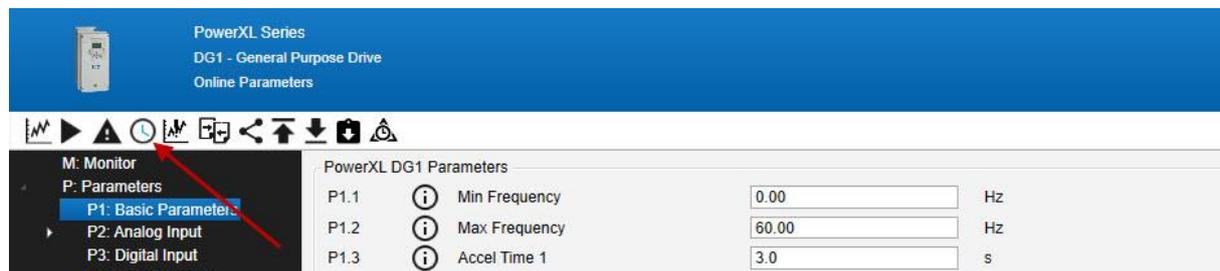
The real time clock gives information about the date (MM.DD.YYY) and the time (HH:MM:SS).

It can be set in different ways:

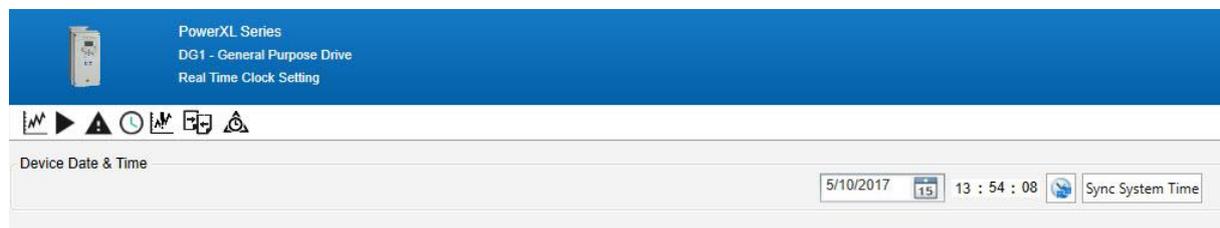
- with the startup wizard at first power on of the device.
- by respective settings of parameter P21.4.1.

It has to be noted, that the format of date and time can change depending on the selected language.

In the configuration software Power Xpert inControl, parameter P21.4.1 cannot be found inside the parameter group “P21: System”, but is available in an own window. Access to this window is possible by clicking on the clock symbol (see below).



A new window appears, where one can set date and time. Alternatively the system time of the PC can be transferred to the drive by clicking on the “Sync System Time” button in online mode.



In case of an RTC fault, it is displayed with code „Real Time Clock Fault (55)“. The response in case of a fault message can be configured with P9.34 “RTC Fault”:

- 0: No response → A fault of RTC will be ignored.
- 1: Warning → No trip occurs. A warning message is generated, in case an output relay is configured accordingly.
- 2: Fault → The device trips. The behavior of the drive in case of battery fault depends on the setting of P7.10 “Stop Mode”. A fault message is generated, in case an output relay is configured accordingly.
- 3: Fault, Coast → The drive trips and the motor coasts to stop. A fault message is generated, in case an output relay is configured accordingly.

„RTC Fault“ is an internal fault of the device. When this fault appears, disconnect the supply voltage from the device and reapply it after approximately 30 s. In case “RTC Fault” still remains, please contact the next Eaton sales office.

By activating Parameter P21.4.2 “Daylight Saving”, it is possible to have an automatic switch over between summer time and winter time. It can be selected, in which region the drive is operated,

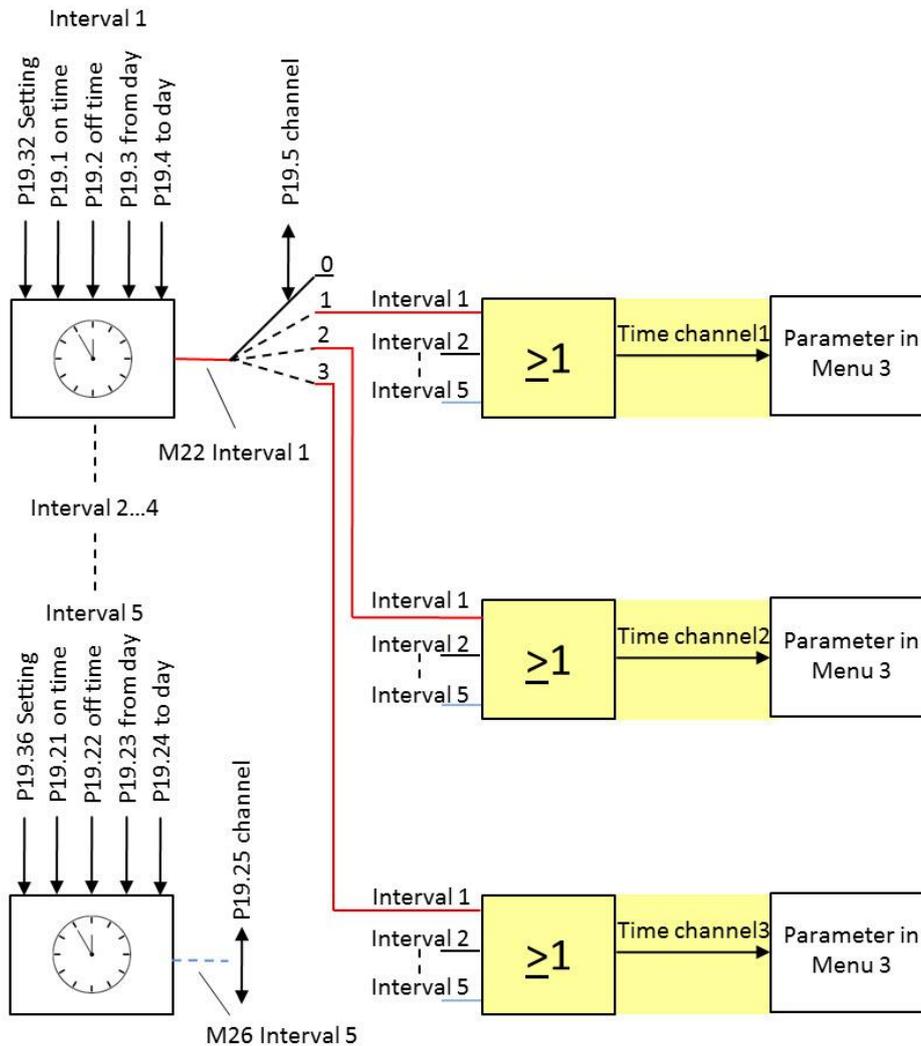
because the point in time, when the switch over takes place, is different in Europe and the US. By default "Daylight Saving" is not activated.

Parameter	Name	Range	Default
M42	Latest Fault Code	1...99 (55 in case of „Real Time Clock Fault“)	-
P9.34	RTC Fault	0: No response 1: Warning 2: Fault 3: Fault, Coast	1
P21.4.1	Real time clock		
P21.4.2	Daylight Saving	0: Off 1: EU 2: US	0: Off

## 4 Use of the timers

Hint: The functions described below are not available in the application „Standard“ (P21.1.2 „Application“ = 0: Standard).

### 4.1 RTC controlled timers (Interval)



One can define up to five independent intervals, when using the time controlled timers. Starting and stopping are defined by setting week days and time. The intervals are assigned to so called time channels. The time channels have HIGH signal, when the interval is active. They are handled inside the drive like digital inputs. When configuring control sources in menu 3, the respective parameters cannot only be assigned to terminals but also to time channels.

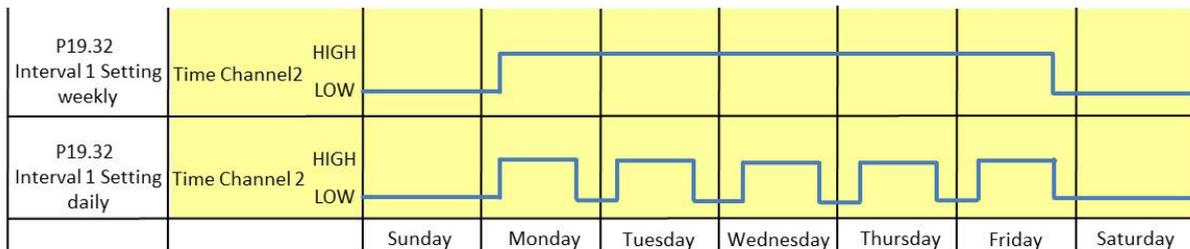
Example:

A pump shall only run in a defined period of time. The times are defined in Interval 1 and Interval 1 is assigned to Time Channel 1. P3.2 defines, where the Start signal for the drive comes from. In this case P3.2 is assigned to Time Channel 1 (P3.2 = 28: Time Channel 1 → the drive always starts, when Interval 1 is active).

In the following descriptions the character “\*” represents the number of the respective interval. The intervals 1 to 5 behave identically.

#### Interval \* Setting (P19.32 ... P19.36)

The example below shows the behavior. Interval 1 is assigned to Time Channel 2:



- weekly
  - The assigned time channel changes at „Interval \* From Day“ at „Interval \* On Time“ o’ clock from LOW to HIGH signal.
  - This status remains until „Interval \* To Day“ at „Interval \* Off Time“ o’clock. Then it changes back to LOW again.
- daily
  - The assigned time channel changes at „Interval \* From Day“ at „Interval \* On Time“ o’ clock from LOW to HIGH signal.
  - On the same day at “Interval \* Off Time” o’clock it changes back to LOW again.
  - This cycle is repeated until „Interval \* To Day“.

Switching on: „Interval \* On Time“ and „Interval \* From Day“

- The time is set in hours, minutes and seconds.
- The week day can be chosen from a selection list.
- Parameters M22...M26 „Interval \*” indicate, if the interval is active or not.

Switching off: „Interval \* off time“ and „Interval \* To Day“

- The time is set in hours, minutes and seconds.
- The week day can be chosen from a selection list.

Assigning an interval to a time channel “Interval \* Channel”

- The intervals are assigned to time channels by the parameters „Interval \* Channel“.
- The time channels are handled like internal digital signals, which can then be assigned to functions inside menu 3 (P3.xx = 28: Time Channel 1 .... 30: Time Channel 3).
- It is possible to assign multiple intervals to the same time channel. The single signals are linked together with a logical OR. This means, that as long as one interval, which is connected with the time channel, has HIGH signal, the time channel has HIGH signal too.
  - Example: The time channel activates the air conditioning for a factory. From Mondays to Thursday they have full day shift, on Fridays the only work until noon. In this case the time for the air conditioner from Monday to Thursday can be defined with interval 1 and the times for Friday with interval 2. Both intervals are assigned to the same time channel.

## M21 „TC1, TC2, TC3“

Displays the status of the three time channels (Format: Time Channel 1, Time Channel 2, Time Channel 3)

Off = Time channel not active

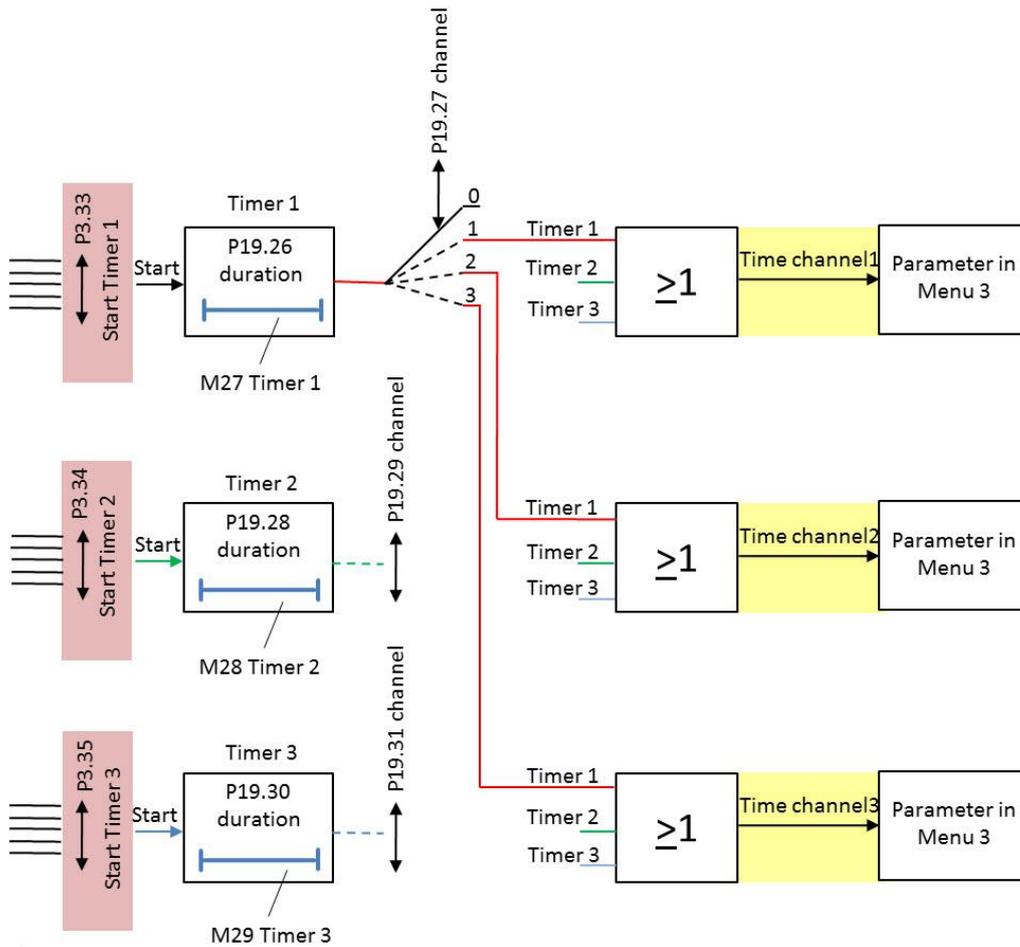
On = Time channel active

Parameter	Name	Range	Default
P3.xx	multiple	0: DigIN:NormallyOpen ... 28: Time Channel 1 29: Time Channel 2 30: Time Channel 3 ... 35: Virtual RO2 Function	
M21	TC1, TC2, TC3	Off = Time channel not active On = Time channel active	
P19.32	Intervall 1 Setting	0: Weekly 1: Daily	0
P19.1	Interval 1 On Time	00:00:00 ... 23:59:59	00:00:00
P19.2	Interval 1 Off Time	00:00:00 ... 23:59:59	00:00:00
P19.3	Interval 1 From Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.4	Interval 1 To Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.5	Interval 1 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M22	Interval 1	0: Inactive 1: Active	0
P19.33	Intervall 2 Setting	0: Weekly 1: Daily	0
P19.6	Interval 2 On Time	00:00:00 ... 23:59:59	00:00:00
P19.7	Interval 2 Off Time	00:00:00 ... 23:59:59	00:00:00
P19.8	Interval 2 From Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0

Parameter	Name	Range	Default
P19.9	Interval 2 To Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.10	Interval 2 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M23	Interval 2	0: Inactive 1: Active	0
P19.34	Intervall 3 Setting	0: Weekly 1: Daily	0
P19.11	Interval 3 On Time	00:00:00 ... 23:59:59	00:00:00
P19.12	Interval 3 Off Time	00:00:00 ... 23:59:59	00:00:00
P19.13	Interval 3 From Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.14	Interval 3 To Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.15	Interval 3 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M24	Interval 3	0: Inactive 1: Active	0
P19.35	Intervall 4 Setting	0: Weekly 1: Daily	0
P19.16	Interval 4 On Time	00:00:00 ... 23:59:59	00:00:00
P19.17	Interval 4 Off Time	00:00:00 ... 23:59:59	00:00:00
P19.18	Interval 4 From Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0

Parameter	Name	Range	Default
P19.19	Interval 4 To Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.20	Interval 4 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M25	Interval 4	0: Inactive 1: Active	0
P19.36	Intervall 5 Setting	0: Weekly 1: Daily	0
P19.21	Interval 5 On Time	00:00:00 ... 23:59:59	00:00:00
P19.22	Interval 5 Off Time	00:00:00 ... 23:59:59	00:00:00
P19.23	Interval 5 From Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.24	Interval 5 To Day	0: Sunday 1: Monday 2: Tuesday 3: Wednesday 4: Thursday 5: Friday 6: Saturday	0
P19.25	Interval 5 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M26	Interval 5	0: Inactive 1: Active	0

## 4.2 Event controlled timers



There are three event controlled timers, which operate independently. Once a Start signal is applied, the output of the timer has HIGH signal for the defined duration. When the time is expired, the status of the timer output changes to LOW again. The start signal must be present during the complete lapse of time. The source for the timer's start signal is defined by P3.33 ... P3.35.

The outputs of the timers are assigned to so called time channels. The time channels have HIGH signal, when the timer is active. They are handled inside the drive like digital inputs. When configuring control sources in menu 3, the respective parameters cannot only be assigned to terminals but also to time channels.

P3.33 „Start Timer 1“

P3.34 „Start Timer 2“

P3.35 “Start Timer 3”

Selection of the source for the timer's start signal. The timer is started with a rising edge of this signal.

M21 „TC1, TC2, TC3“

Displays the status of the three time channels (Format: Time Channel 1, Time Channel 2, Time Channel 3)

Off = Time channel not active

On = Time channel active

P19.26 „Timer 1 Duration“

P19.28 „Timer 2 Duration“

P19.30 „Timer 3 Duration“

Determines the run time of a timer. A rising edge of the start signal is needed to set the timer's output to HIGH. After expiration of the time defined here it changes to LOW again. To restart the timer another rising edge is necessary. In case the start signal changes to LOW while the timer is running, the output is set to LOW immediately.

M27 „Timer 1“

M28 „Timer 2“

M29 „Timer 3“

Remaining time of an active timer, until the timer's output changes from HIGH to LOW.

P19.27 „Timer 1 Channel“

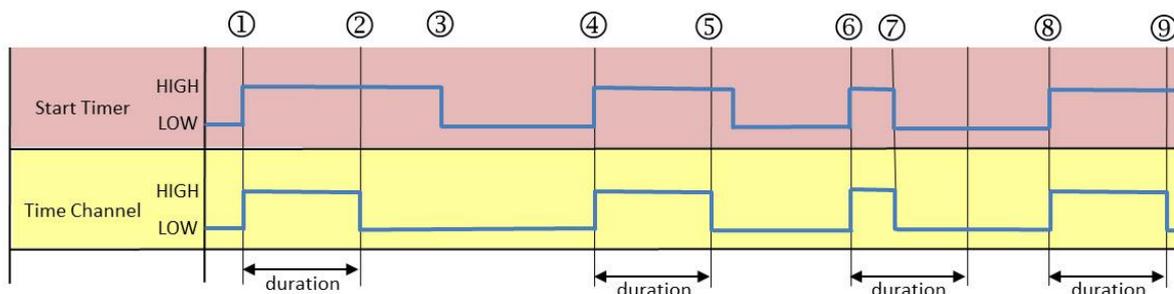
P19.29 „Timer 2 Channel“

P19.31 „Timer 3 Channel“

Assigning a of timer to a time channel

- The timers are assigned to time channels by the parameters „Timer \* Channel“.
- The time channels are handled like internal digital signals, which can then be assigned to functions inside menu 3 (P3.xx = 28: Time Channel 1 .... 30: Time Channel 3).
- It is possible to assign multiple timers to the same time channel. The single signals are linked together with a logical OR. This means, that as long as one timer, which is connected with the time channel, has HIGH signal, the time channel has HIGH signal too.

Example:



- ① The rising edge of the start signal activates the timer.
- ② After expiration of the time set with „Timer \* Duration“ the output is set to LOW, even when the start signal still remains.
- ③ The start signal changes to LOW. Because the timer is not active at this time, this has no impact on its status.
- ④ The rising edge of the start signal activates the timer.
- ⑤ After expiration of the time set with „Timer \* Duration“ the output is set to LOW, even when the start signal still remains.
- ⑥ The rising edge of the start signal activates the timer.
- ⑦ The start signal changes to LOW before „Timer \* Duration“ is expired. The output of the timer changes to LOW too.
- ⑧ The rising edge of the start signal activates the timer.
- ⑨ After expiration of the time set with „Timer \* Duration“ the output is set to LOW, even when the start signal still remains.

Parameter	Name	Range	Default
M21	TC1, TC2, TC3	Off = Time channel not active On = Time channel aktive	-
P3.33	Start Timer 1	0: DigIN:NormallyOpen 1: DigIN:NormallyClose 2: DigIN 1 3: DigIN 2 4: DigIN 3 5: DigIN 4 6: DigIN 5 7: DigIN 6 8: DigIN 7 9: DigIN 8 10: DigIN: A: IO1: 1 (on DXG-EXT-3DI3DO1T) 11: DigIN: A: IO1: 2 (on DXG-EXT-3DI3DO1T) 12: DigIN: A: IO1: 3 (on DXG-EXT-3DI3DO1T) 13: DigIN: A: IO5: 1 (on DXG-EXT-6DI) 14: DigIN: A: IO5: 2 (on DXG-EXT-6DI) 15: DigIN: A: IO5: 3 (on DXG-EXT-6DI) 16: DigIN: A: IO5: 4 (on DXG-EXT-6DI) 17: DigIN: A: IO5: 5 (on DXG-EXT-6DI) 18: DigIN: A: IO5: 6 (on DXG-EXT-6DI) 19: DigIN: B: IO1: 1 (on DXG-EXT-3DI3DO1T) 20: DigIN: B: IO1: 2 (on DXG-EXT-3DI3DO1T) 21: DigIN: B: IO1: 3 (on DXG-EXT-3DI3DO1T) 22: DigIN: B: IO5: 1 (on DXG-EXT-6DI) 23: DigIN: B: IO5: 2 (on DXG-EXT-6DI) 24: DigIN: B: IO5: 3 (on DXG-EXT-6DI) 25: DigIN: B: IO5: 4 (on DXG-EXT-6DI) 26: DigIN: B: IO5: 5 (on DXG-EXT-6DI) 27: DigIN: B: IO5: 6 (on DXG-EXT-6DI) 28: Time Channel 1 29: Time Channel 2 30: Time Channel 3 31: RO1 Function 32: RO2 Function 33: RO3 Function 34: Virtual RO1 Function 35: Virtual RO2 Function	0
P19.26	Timer 1 Duration	0 ... 72000 s	0 s
P19.27	Timer 1 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M27	Timer 1	0 ... 72000 s	0
P3.34	Start Timer 2	See P3.33	0
P19.28	Timer 2 Duration	0 ... 72000 s	0 s
P19.29	Timer2 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M28	Timer 2	0 ... 72000 s	0

Parameter	Name	Range	Default
P3.35	Start Timer 3	See P3.33	0
P19.30	Timer 3 Duration	0 ... 72000 s	0 s
P19.31	Timer 3 Channel	0: Not Used 1: Time Channel 1 2: Time Channel 2 3: Time Channel 3	0
M29	Timer 3	0 ... 72000 s	0