

Dynavert – Modbus TCP

Zu Dynavert wurde nun die Möglichkeit geschaffen, mittels MODBUS TCP zu kommunizieren.

Das MODBUS -Protokoll ist ein weltweit verbreitetes Kommunikationsprotokoll, das auf einer Master/Slave- bzw. Client/Server-Architektur basiert, welches allen Anwendern offen gelegt ist und von vielen Herstellern unterstützt wird. Es wurde für die Kommunikation mit programmierbaren Logik-Controllern entwickelt.

Modbus hat sich als Standard in der Industrie etabliert. Darauf aufsetzend wurde für den Einsatz in modernen Netzwerken MODBUS/TCP entwickelt. Dieses Protokoll ist heute ein offener Internet-Draft-Standard, der in die für Internet-Standardisierung zuständige Organisation eingebracht wurde. Durch diese Offenlegung kann jeder Hersteller und Anwender dieses Protokoll implementieren.

- Mittels Modbus können ein Master (z.B. ein PC) und mehrere Slaves (z. B. Mess- und Regelsysteme) verbunden werden. Bei der Datenübertragung werden drei verschiedene Betriebsarten unterschieden:
 - MODBUS ASCII
 - MODBUS RTU
 - MODBUS TCP

Mit der steigenden Ausweitung der Ethernet- Kommunikation, sowohl im industriellen als auch im Büro-Bereich, erfährt MODBUS/TCP eine zunehmend breiter werdende Anwendung in allen Branchen. Insbesondere heterogene Systemlandschaften sind typische Einsatzfelder.

MODBUS RTU für konventionelle serielle Kommunikation ist bereits seit langem für Dynavert verfügbar, nun ist MODBUS/TCP als weitere Kommunikationsmöglichkeit geschaffen worden.

Anbei finden Sie ein Dokument, welches Ihnen weitere Informationen zur entsprechenden Geräteplatine wie auch Handhabung erläutert. Diese Platine ist auf Anfrage erhältlich.

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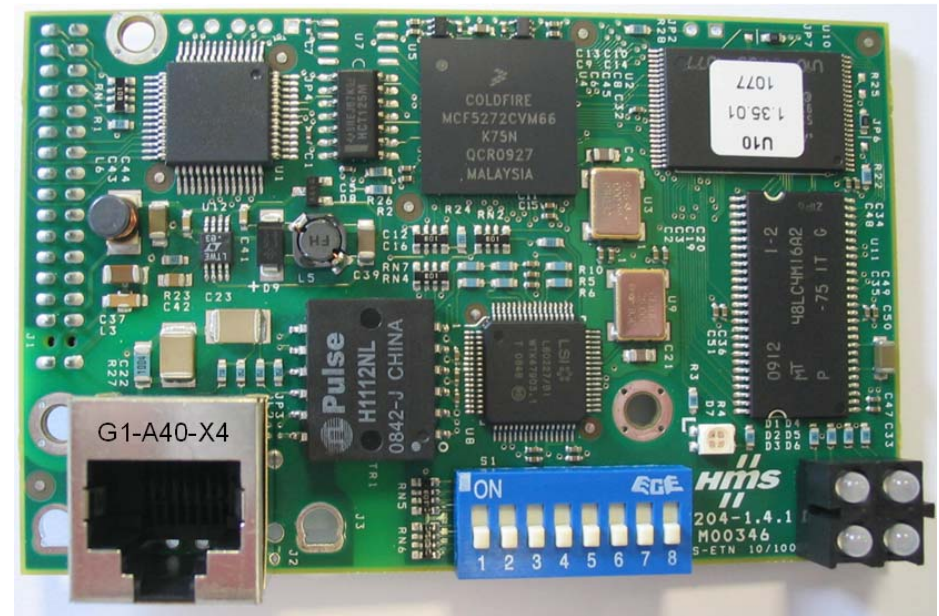
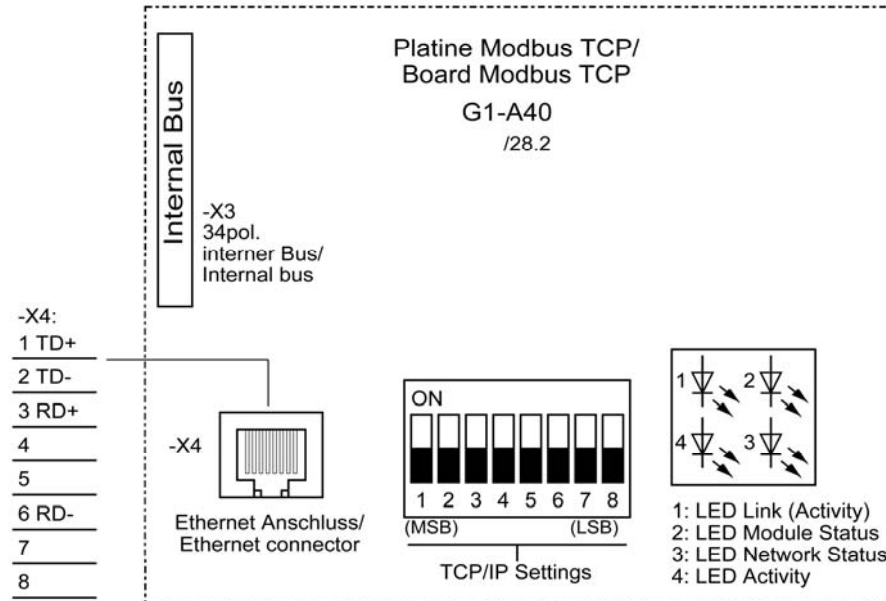
Modbus Parameter Mapping for *DYNAVERT T-Drives*

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DYNAVERT Umrichter

Modbus communication board (Modbus TCP)

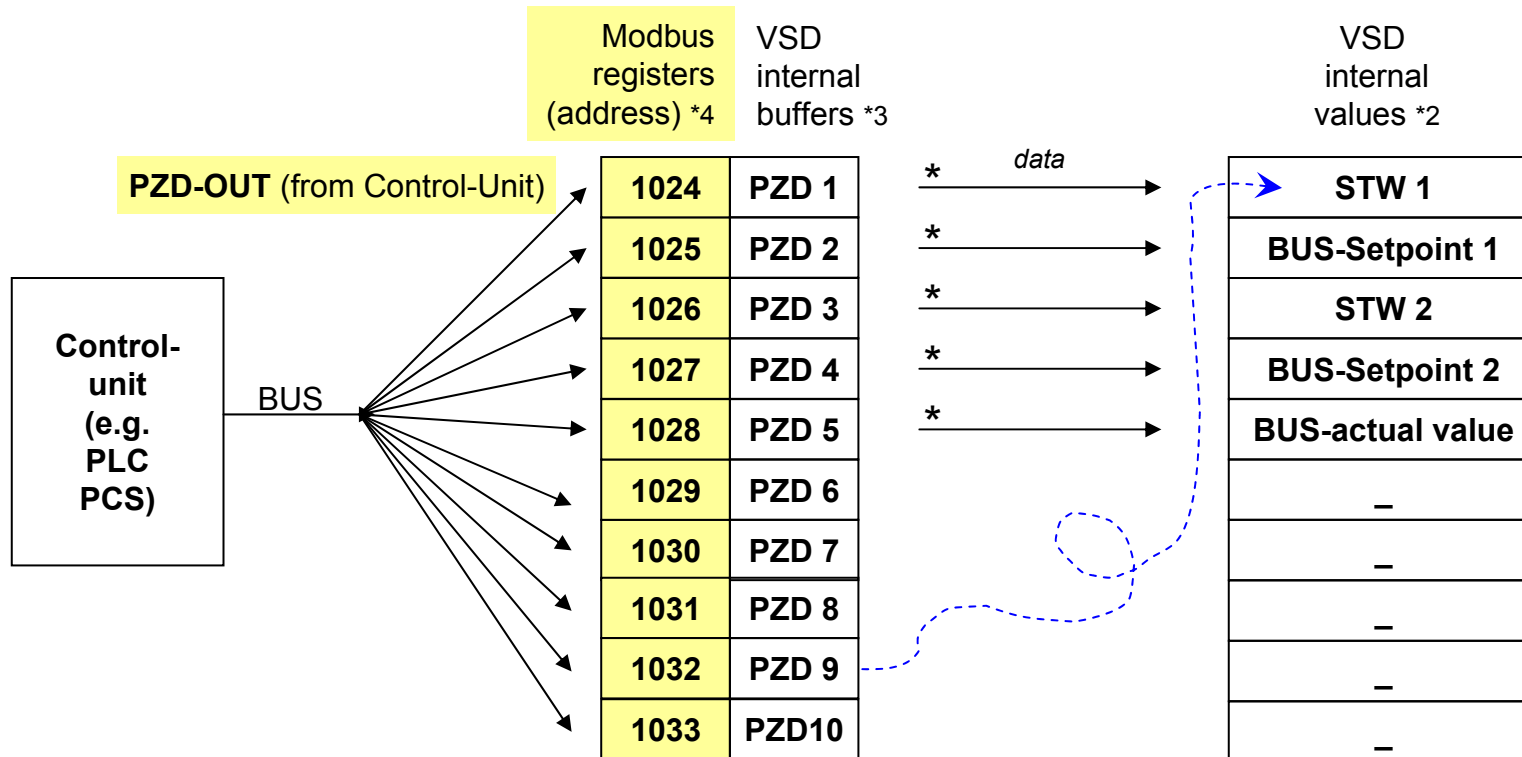


Component	Function	
LED 1 "Link (Activity)"	Aus	No Connection found
	Grün leuchtend	Connection found
LED 2 "Module Status"	Aus	No supply voltage for the module
	Grün blinkend (1 Hz)	No IP-address set by the configuration switches
	Rot blinkend (1 Hz)	No valid MAC-address (internal error)
	Rot blinkend (2 Hz)	Ethernet configuration could not be read from flash
	Rot blinkend (4 Hz)	Internal error (fatal)
	Rot	Already used IP-address found
LED 3 "Network Status"	blinkt n-mal	The amount of flashes of the LED equals the Modbus-TCP connections
LED 4 "Activity"	Grün blinkend	Data transfer in progress (send/receive)

Component	Function
Dip-Switches for configuration	The Dip-Switches define the last Byte of the IP-Address
	<p><u>TCP/IP-settings with IMS-software:</u> Select "PARAMETER" > "P-INTERFACE" > "P-Profibus/Modbus" > "P-Modbus TCP". There the Parameters for IP-Address TCP/IP and Sub-Net TCP/SN as well as the Gateway TCP/GW can be selected.</p>
	<p><u>TCP/IP-settings with Hardware (Dip-Switches):</u> To use the Hardware (Dip-Switches) you have to set the IP-Address to 0-0-0-0 (by use of the IMS-Software as described above). In case the IP is set to 0-0-0-0 the following standards will be used by completion with the setting of the Dip-Switches: IP-Address: 192.168.0.X (X is the value of the Dip-Switch) Gateway: 0.0.0.0 Subnet: 255.255.255.0</p>
	The Dip-Switches define the last Byte of the IP-Address (binary coded). The IP-Address of the example on the left is 192.168.0.42 (out of 32+8+2)

Control unit writes data to inverter (PCS) --> (VSD)

Variable Speed Drive (VSD) is always passive from Modbus communication point of view. VSD provides selected internal values to registers via internal buffers. The Control unit has to read or write to the VSD “registers”



(*4) Modbus-Register addresses from 1024 to 1033 are fixed set by the VSD-System and could not be changed or modified!

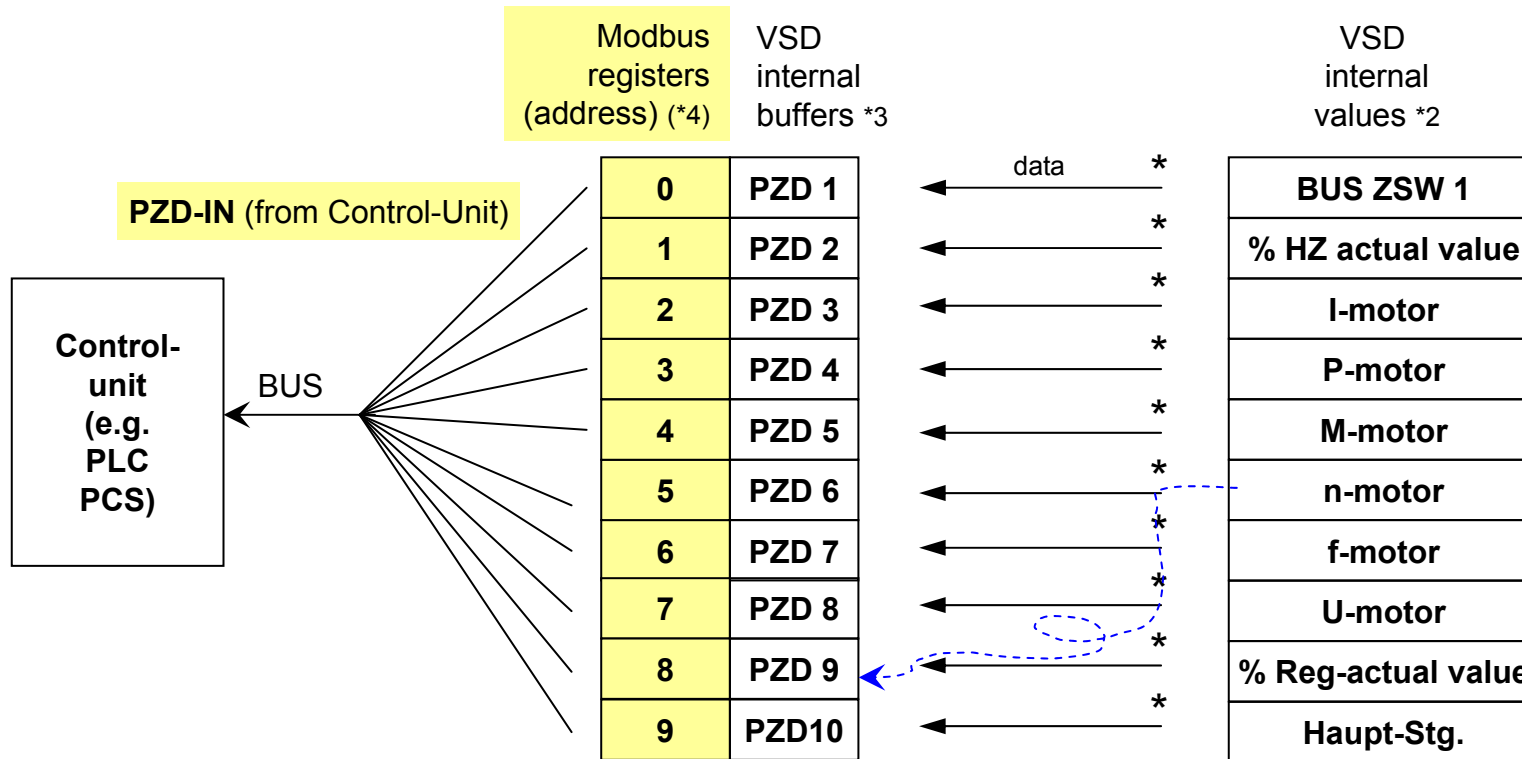
(*1) Each correlation between internal value of the VSD and the internal PZD-buffer could be changed individual if needed (-> e.g. like with the blue lines shown)

(*2) From the Host accessible Internal VFD-values are: STW 1, BUS-Setpoint 1, STW 2, BUS-Setpoint 2, BUS-actual value. This values could be arranged by use of the Inverter Management System (IMS) to any of the PZD-buffers

(*3) Each VSD offers 10 PZD-buffers (registers) in both directions

Control unit reads data from inverter (PCS) <-- (VSD)

Variable Speed Drive (VSD) is always passive from Modbus communication point of view. VSD provides selected internal values to registers via internal buffers. The Control unit has to read or write to the VDS “registers”



(*4) Modbus-Register addresses from 0 to 9 are fixed set by the VSD-system and could not be changed or modified!

(*) Each of the correlation between internal values of the VSD and the internal buffer could be changed individual if needed (-> e.g. like with the blue lines shown)

(*2) Other internal VFD-values could be chosen (selected) by use of the Inverter Management System (IMS)

*3 Each VSD offers 10 PZD-buffers (registers) in both directions

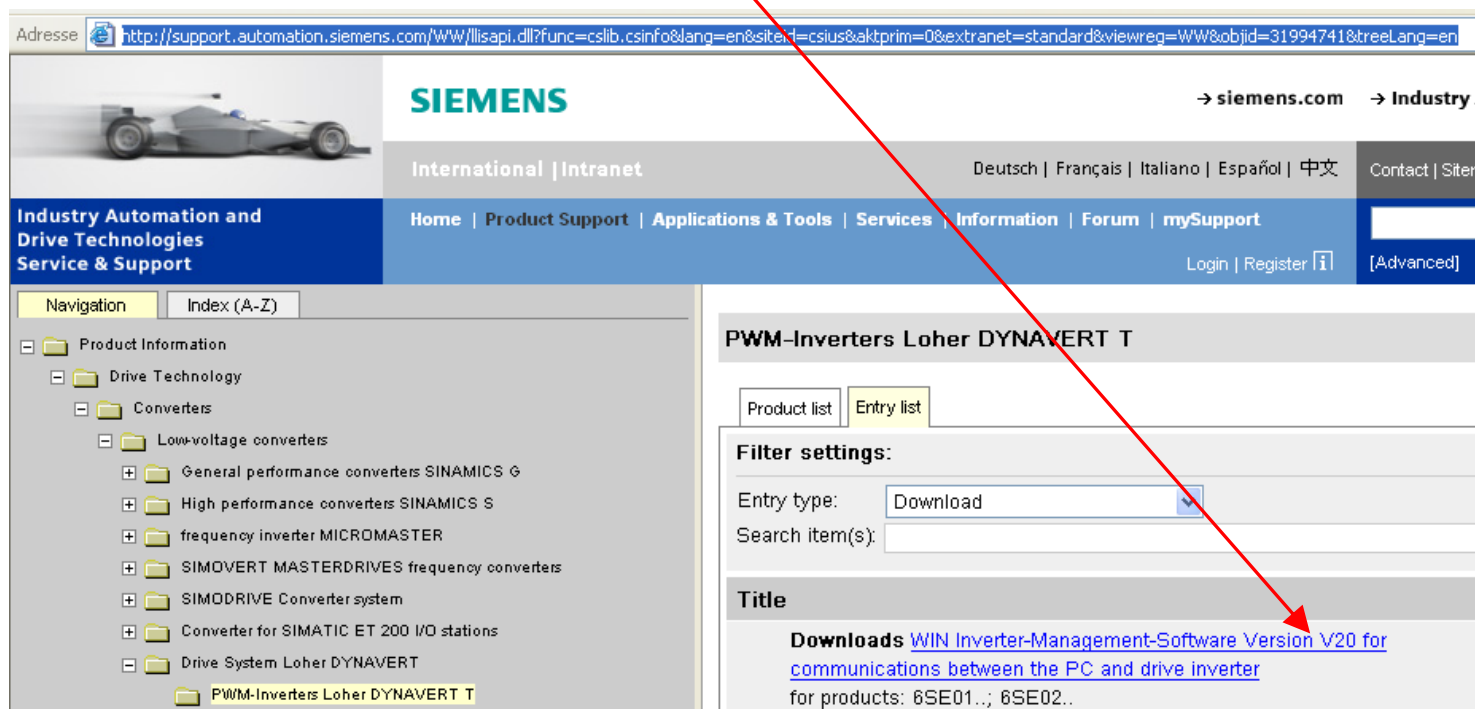
Setup of the VSD buffers with internal values – How does this work?

To better understand the setup of the internal buffers download the **IMS-Software** and install it. You will work in “offline mode” and see directly, what is possible to do and what values are available in the system. Don't worry, the software is small and easy to operate and you will really better understand the system within minutes!

-> Use this link for download:

<http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&siteid=csius&aktprim=0&extranet=standard&viewreg=WW&objid=31994741&treeLang=en>

-> The Link will show you this page, click on the download and install the software!



The screenshot shows the Siemens support website interface. The address bar displays the URL: <http://support.automation.siemens.com/WW/llisapi.dll?func=cslib.csinfo&lang=en&siteid=csius&aktprim=0&extranet=standard&viewreg=WW&objid=31994741&treeLang=en>. The page title is "PWM-Inverters Loher DYNAVERT T". The navigation menu includes "Product Information", "Drive Technology", "Converters", "Low-voltage converters", "General performance converters SINAMICS G", "High performance converters SINAMICS S", "frequency inverter MICROMASTER", "SIMOVERT MASTERDRIVES frequency converters", "SIMODRIVE Converter system", "Converter for SIMATIC ET 200 I/O stations", "Drive System Loher DYNAVERT", and "PWM-Inverters Loher DYNAVERT T". The "Filter settings" section shows "Entry type: Download" and "Search item(s):". The "Title" section contains the link: [Downloads WIN Inverter-Management-Software Version V20 for communications between the PC and drive inverter for products: 6SE01...; 6SE02..](#). A red arrow points from the URL in the address bar to the download link in the "Title" section.

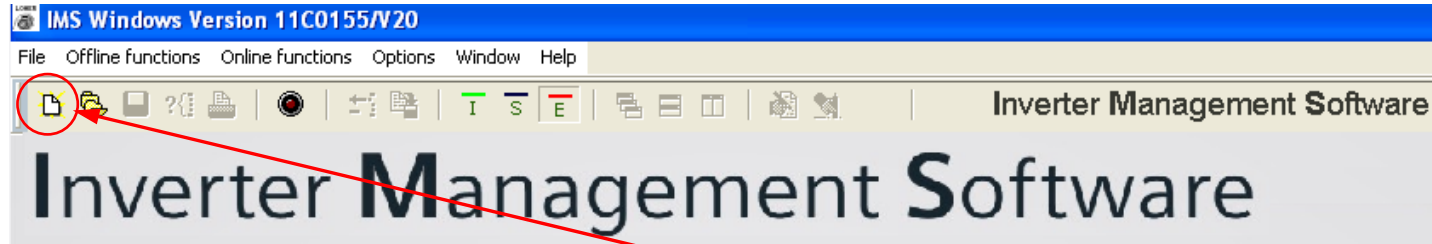
-> After Installation you get this icon to start IMS with:



Inverter Management Software.

Setup of the VSD buffers with internal values – How does this work?

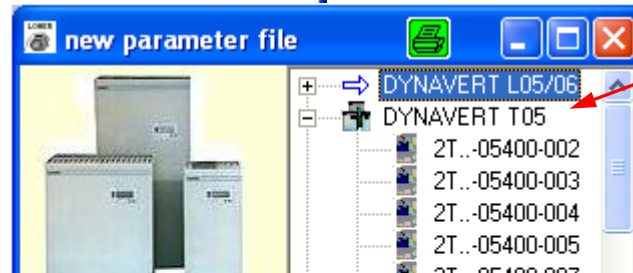
-> IMS starts with a screen like this....



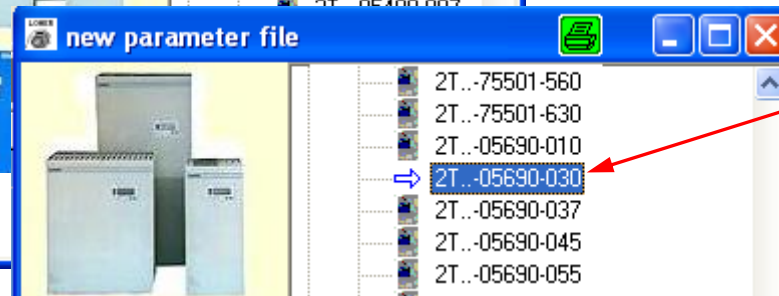
-> You can start immediately by click on the “set up new Inverter” button (you are automatically in “offline”)



-> IMS presents you the overview of the various types of Dynavert VSD (Variable Speed Drives)



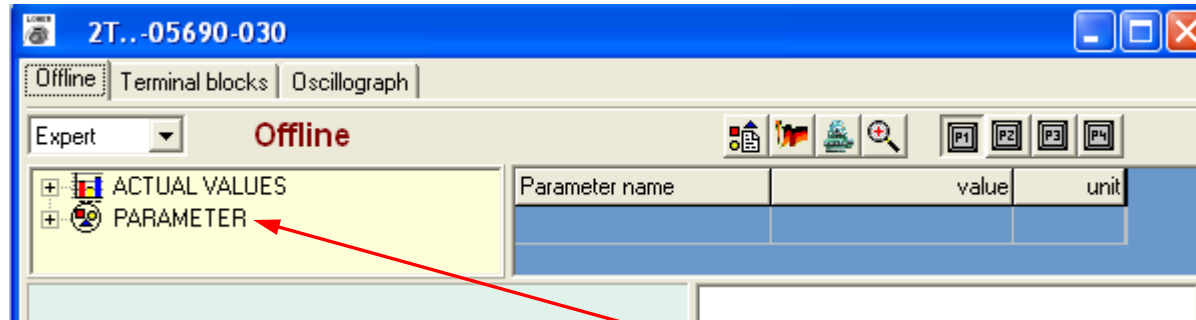
-> Select the Dynavert T05



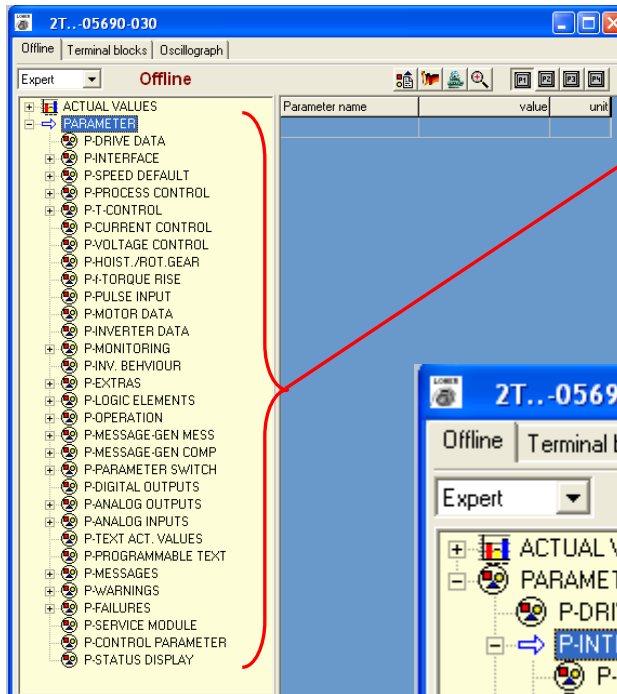
-> As example:
Select the 690V
30kW compact drive
2TA-05690-030

Setup of the VSD buffers with internal values – How does this work?

-> You are now getting access to the parameters of the Dynavert T – Drive....

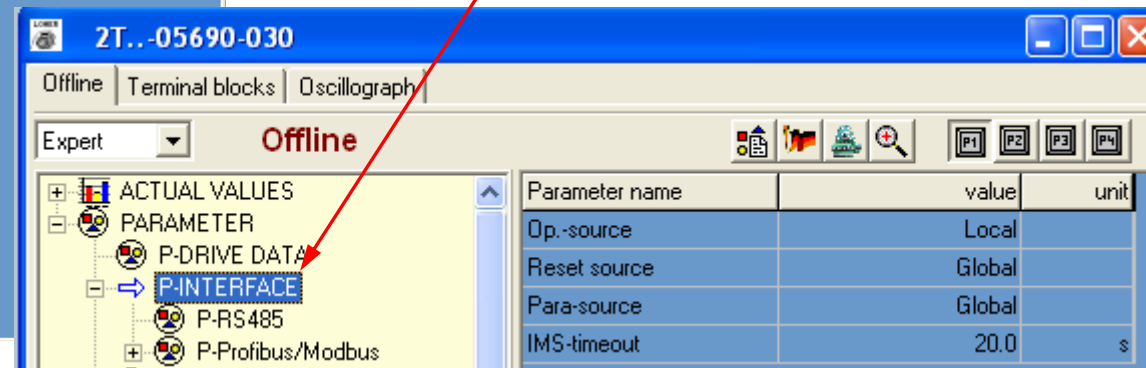


-> Open the parameter set with a click on "PARAMETER"



-> This opens the overview of all available parameters grouped in functional order

-> A click in the P-INTERFACE opens the grouping for the communication bus



Setup of the VSD buffers with internal values – How does this work?

-> Click to **P-Profibus/Modbus** to open the overview of the relevant parameter-groups for communication

The screenshot displays the IMS Windows software interface. The top-left pane shows a tree view of parameters under 'P-INTERFACE', with 'P-Profibus/Modbus' selected. The top-right pane shows a table of parameter names and their values. The bottom-left pane shows a tree view with 'P-PZD OUT-Data' selected. The bottom-right pane shows a list of PZD buffers for 'STW 1'.

Parameter name	value	unit
Revers.	STW1 Bit11	
STW 1	PZD 1	
BUS-SetVal1	PZD 2	
STW 2	PZD 3	
BUS-SetVal2	PZD 4	
BUS-ActVal	PZD 5	

STW 1
PZD 1
PZD 2
PZD 3
PZD 4
PZD 5
PZD 6
PZD 7
PZD 8
PZD 9
PZD 10

-> Click to **P-PZD OUT-Data** opens the view for the correlation of the internal values to the PZD-buffers

-> Click to **PZD 1** opens the new window with the correlation of the internal values to the PZD-buffers

-> By click to **"PZD x"** or **"PZD y"** you can modify which of the PZD-buffers should contain the internal value (e.g. in this example the STW 1)

Setup of the VSD buffers with internal values – How does this work?

-> Analog to the OUT-Data (**out** of the control-unit with direction to the VSD Variable Speed Drive) you can select and arrange the In-Data (**in** to the control-unit from the VSD) by click to the **PZD IN-Data**.

The screenshot shows the IMS Windows software interface. The main window displays a tree view on the left and a table of parameters. The tree view shows the following structure:

- PARAMETER
 - P-DRIVE DATA
 - P-INTERFACE
 - P-RS485
 - P-Profibus/Modbus
 - P-Profibus
 - P-Modbus RTU
 - P-Modbus TCP
 - P-ZSW1 free bit
 - P-ZSW2 free bit
 - P-PZD OUT-Data
 - P-PZD IN-Data** (highlighted)
 - P-SPEED DEFAULT

The table of parameters is as follows:

Parameter name	value	unit
PZD 1	BUS ZSW 1	
PZD 2	%Hz-Act.val	
PZD 3	I-motor	
PZD 4	P-motor	
PZD 5	T-motor	
PZD 6	n-motor	
PZD 7	f-motor	
PZD 8	V-motor	
PZD 9	%CtrlActVal	
PZD 10	Comm. fault	

The secondary window titled 'PZD 6' shows a list of internal values that can be assigned to the PZD buffer:

- n-motor
- Speed
- I-motor
- V-motor
- f-motor
- T-motor
- T r/l
- P-motor
- EarthCurr.
- ON-hrs.
- Opn-hrs.
- T-KTY84 AI1
- Mn-SV
- Dif-SV
- Add-SV
- SetVal
- Aux-SV
- f-SV PreCt
- LimValue
- ActV.
- Freq.act.
- Tacho act
- Pulse act
- BUS STW 1
- BUS STW 2
- BUS-SetVal1
- BUS-SetVal2
- BUS-ActVal
- BUS ZSW 1
- BUS ZSW 2
- %Hz-Act.val
- %CtrlActVal
- Comm. fault
- MELD_NAMUR
- DC-volts
- I-limit
- Iq-ref
- Op.-source
- Set source
- Status
- >Commnd
- RlsMode
- Par-Set
- T-inside
- T-heatsnk max
- T-diff. max
- T-rectif. max
- T-cabin. max
- AI 1
- AI 2
- AI Sys1
- AI Sys2
- AI Sys3
- AI Sys4
- User act.1
- User act.2
- User act.3
- User act.4
- FaultSuppr.
- inactiv

-> Click to the values, e.g. **"I-motor"** opens the new window showing all connectable internal values to the PZD-buffers (in this example to PZD 6)

-> You now can now arrange any of the provided values to the PZD-buffer (in this example PZD 6) by click on the **value of your choice**. This value will be assigned to the internal PZD-buffer and therefore to a related Modbus-Register. This register can be read by the Host-System (Control-unit).

Control-unit to read data from the Drive... To read motor current and motor speed

Motor current:

In the example the motor current is provided in PZD 3 (Modbus Register 2) and could be read from the control system with **function code 4 “read input register” to Register address 2.**

The scaling of e.g. the current value is depending on the power-size of the Inverter - e.g. 690V Drives with low Power (7,5kW, 11kW, 15kW, 22kW, 30kW) have a resolution of 1 digit after the decimal point (####,#A) -> resolution over the bus is 0,1A!

-> A value of e.g. 173 over the bus is equivalent 17,3 A

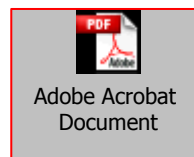
Motor speed (turnarounds):

Motor turnarounds **rpm** are in the example transferred to PZD 6 (Register 5) and could be read from the control system with **function code 4 “read input register” to Register address 5.**

The rounds per minute are always (in every size of the Dynavert drives) integer on the bus and are not scaled. 150 on the bus is equivalent 150rpm, 3000 is equivalent 3000rpm.

All further details to the normalization of the parameters and the “over the bus” available values could be found in the “DYNAVERT T Instructions for Parameterizing”

-> Look as well at the following pages in this instruction!



click to open

DYNAVERT® T

Instructions for Parameterizing

4BS0550-004-en

Type range T05

LOHER

Control-unit to read data from the Drive...

Your way through the “DYNAVERT T Instructions for Parameterizing”

Beside of “motor speed” and “motor current” there are several other (internal) **PZD-IN** data of the Drive available to be swapped to the PZD-buffers.

A complete listing you find in the “DYNAVERT T Instructions for Parameterizing” Attached the extracts of the PZD-IN data and the Normalization of the Drive data.

PZD-IN data (Page 44):

7 Annexes

7.1 Actual values for status, analog output, comparison message and PROFIBUS

Explanations of titles on the table:
 x in Smoothing The respective signal is smoothed with the indicated ms-value.
 x in Status The actual value can be parameterized in a line of the inverter display.
 x in AA The actual value can be parameterized as an analog output signal.
 x in COMP The actual value can be parameterized as an actual-signal for a comparison message.
 x in PZD-IN The actual value can be parameterized and transferred via PROFIBUS in the PZD-IN area.
 Short designation Short designation of format of the actual value (normally used with Profibus, e.g. I2 = Integer with 2*8 Byte)
 Format Format of the actual value, e.g. Integer 16: from -32768 to +32767 or unsigned 16: from 0 to 65535
 Display-unit The unit displaying the actual value on the inverter display.
 Physical quantity Physical quantity of the actual value.
 Quantities/conversion index Values are possibly needed for transfer with Profibus for presentation in another number format.
 Standard value, analog outputs and comparison messages: further information

click to open



Actual value	Explanation/accuracy	Smoothing [ms]	Status	AA	COMP	PZD-IN	Short designation	Format	Display-unit	Physical quantity	Quantities index	Conversion-Index	Standard value Analog outputs and comparison messages
n-Motor	Motor speed Accuracy: ±1% with SVC with correctly set slip compensation ±0,1% at FOC of the nominal motor speed	320	x	x	x	x	I2	Integer 16	rpm	speed	11	67	n-Motor ¹

Normalization of the Drive data (Page 54):

7.2 Inverter-type dependent data normalization

If the conversion index is -1, the actual value will have one decimal place, and so on.

click to open



Inverter type	T-motor T-mot r/l Display unit	I-motor I-limit Conversion index	P-motor Conversion index	T-motor T-mot r/l Conversion index BUS
T07-7,5/690	Nm	-1	-2	-1
T07-11/690	Nm	-1	-2	-1
T07-15/690	Nm	-1	-1	-1
T07-22/690	Nm	-1	-1	-1
T05-30/690	Nm	-1	-1	-1
T05-27/690	Nm	1	1	1

Control-unit to read data from the Drive... To check the Drive status (generals)

To read the Status of the Drive the Host (Control-Unit) has to **read Modbus-Register 0** (equals Drive-internal PZD 1, which carries the Drive-Status-Value-Word **BUS ZSW1**).

The Host-System then has to evaluate the Drives-Status by checking the settings of the Bits in Register 0.

Always: Do not evaluate “Bit by Bit” in the Drive – you might loose integrity of the information!
→ Save time and read the whole register then evaluate this data afterwards in the Host!

To get a clear understanding of the dependencies of (and between) the bits see the following recommended 3 Pages of the “DYNAVERT T Instructions for Parameterizing”

Page 31 “BUS ZSW1 data”: 4.5 Status word BUS ZSW1



click to open

Bit	Value	Meaning as per profile	Meaning at the inverter
0	1	Ready for switching on	Electronics provided with voltage and initialized, no fault
	0	Not ready for switching on	Mains OFF
1	1	Ready for operation	No fault and no OFF1 given
	0	Not ready for operation	
2	1	Operation released	No fault, no OFF1 and ctrl released given

Page 32 “BUS ZSW1 Bit-Pattern overview”:



click to open

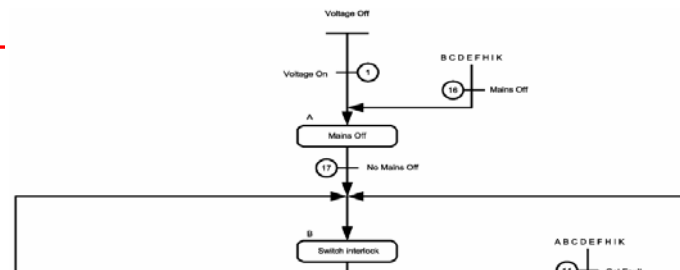
Status diagram position (s. page 6)		BUS ZSW1 Bit-Pattern overview																
BUS ZSW1		Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
A	Mains OFF	x	x	x	x	x	0	1	0	0	0	1	1	0	0	0	0	X230 H
B	Switch interlock	x	x	x	x	x	0	1	0	0	1	1	1	0	0	0	0	X270 H
	Switch interlock of OFF2	x	x	x	x	x	0	1	0	0	1	1	0	0	0	0	0	X260 H
	Switch interlock of OFF3	x	x	x	x	x	0	1	0	0	1	0	1	0	0	0	0	X250 H
G	Switch interlock of OFF2 and OFF 3	x	x	x	x	x	0	1	0	0	1	0	0	0	0	0	0	X240 H
	Fault (not ready for switching on)	x	x	x	x	x	0	1	0	0	0	x	x	0	0	0	0	X238 H

Page 6 “Drive Status diagram”:



click to open

2.2 Status diagram



Control-unit to read data from the Drive...

To check the Drive status (Examples for “Drive in operation or not?”)

The Drive is internally structured as a “State Machine” -> see **page 6** “Status diagram” and **page 32** “BUS ZSW1”.

Main “Logical States” are:

G Failure, **B** Switch interlock, **C** Ready for switching on, **D** Ready for operation, **E** Operation released, **F** Operation

“G” - Drive Failure:

This is the most easy to evaluate Status, represented by Bit 3 of the BUS ZSW1 (= Modbus register 0).

Bit 3 = 1 indicates the Drive has detected an error!

G	Fault (not ready for switching on)	x	x	x	x	x	0	1	0	0	0	0	x	x	1	0	0	0
---	------------------------------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

“A” - Drive (Inverter) is unavailable:

Bit 0 indicates the Drive is in general available (**Bit 0 = 0** -> Drive is not ready for switching on, e.g. Mains are off)

Bit 6 indicates the Drive is not interlocked (**Bit 6 = 0** -> Drive is not interlocked)

A	Mains OFF	x	x	x	x	x	0	1	0	0	0	1	1	0	0	0	0
---	-----------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

“F” Drive (Inverter) is running:

Bit 3 indicates the Drive has detected an error (Bit 3 = 0 -> No Error)

Bit 10 indicates the Drive is in operation (**Bit 10 = 1** -> Drive-System is running, speed ON and controller released)

F	Operating status (run-up/return)	x	x	x	x	x	1	1	0	0	0	x	x	0	1	1	1
	Operating status (SWE)	x	x	x	x	x	1	1	1	0	0	x	x	0	1	1	1

**To consider: If the speed-set-point is 0 (zero), speed-output is as well 0
-> then the Drive is for certain “running” (and in operation)!**

Control-unit to write data to the Drive... To control the Drives operation -> start

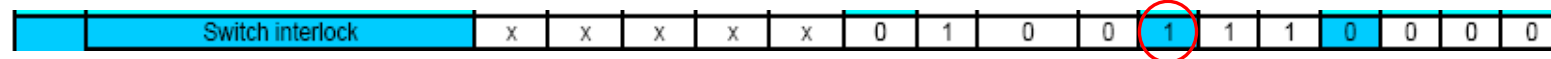
Beside the already shown examples the state of the Drive needs to be known in the Control-Unit before the Control-Unit can control (send commands to) the Drive. -> All possible states to find on the page 32 table.

For the Distributed-Control-System that means:

1. Evaluate constantly what state the drive actual is in (some already explained – others to follow)
2. Decide what action (command) the drive requires to change this state (see the state diagram on page 6)

“B” Switch interlock:

If Mains are switched on the Drive is powered up and change state from “A” (Mains Off) to “**B**” **Switch interlock**. Normally the DCS will find the drive after switching on in this state, waiting for commands (if no Error occurred).



Unlock (and operate) the drive:

To set preset conditions (for stepping further in the Drive-state-machine) the DCS has to write to Modbus **register 1024** (to internal Drive-buffer PZD1 -> **STW1**) the value with the bit pattern as shown:

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
STW 1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0

This sets in the **STW1** the **Bit 1 = 1** (No OFF1) and the **Bit 2 = 1** (No OFF2).

This (pre-) setting allows the DCS to control the drive by **Bit 0** only!
-> The DCS can now **START** and **STOP** the Drive with one Bit only!

Total functionality (content) of the **STW1** -> see page 33:



click to open

4.6 Control Word STW1

Bit	Value	Meaning as per profile	Meaning at the inverter
0	1	ON	No OFF1
	0	OFF1	Braking along ramp
1	1	Operating status	No OFF2
	0	OFF2	OFF2 activated
2	1	Operating status	No emergency stop

Control-unit to write data to the Drive... To control the Drives operation -> start (continued)

“C” Ready for switching on:

After sending the STW1 to “unlock” the Drive-state changes from “B” to “C” Ready for switching on.

C	Ready for switching on	x	x	x	x	x	0	1	0	0	0	x	x	0	0	0	1
---	------------------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

“F” Operation:

Setting of Bit 0 = 1 of the STW1 forces the Drive to leave state “C” and switch directly to “F” Operation.

The DCS has to write to Modbus register 1024 the value with the bit pattern as shown (-> set **Bit 0 = 1**):

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
STW 1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1

With this the Drive-state-machine finds all conditions fulfilled (Bit 0 = 1, Bit 3 = 1, Bit 6 = 1) and goes immediately to “F” Operation.

F	Operating status (run-up/return)	x	x	x	x	x	1	1	0	0	0	x	x	0	1	1	1
	Operating status (SWE)	x	x	x	x	x	1	1	1	0	0	x	x	0	1	1	1

If the setpoint is > 0 (more than 0) the Drive will accelerate the Motor according to the Drives Ramp setting.

If the Drive had not reached its setpoint value (with tolerance) Bit 8 will remain 0.

If the setpoint is reached Bit 8 will change to 1 as well.

If the setpoint is 0 the Drive will not accelerate the Motor -> no Motor speed, but Drive is operating (running)!

Control-unit to write data to the Drive... To control the Drives operation -> stop

“H” Off 1

Like explained is it possible to control the drive by one bit only

-> any change of the Bit 0 in the STW1 will change the state of the drive!

To **stop** the Drive the DCS has to write to Modbus register 1024 the value with the bit pattern as shown (-> set Bit 0 = 0):

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
STW 1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0

After setting Bit 0 of the STW 1 to 0, the drive falls to “H” Off 1.

The Drive decelerates with its settings of the ramp-down.

This action can be executed from state “F” as well as from “D” or “E” -> look it up in the state diagram!

Two ways to leave “Off 1”

- Until speed 0 is not reached, “Off 1” will be left if Bit 0 will be set to 1 again!
The drive will in this case jump directly to state “F” again, as Bit 6 (setpoint released, Speed on) remains still 1.
- “Off 1” will be left if the speed 0 (stand still) is reached – the Drive change to state “C” ready for switching on.
IGBTs of the Drive are locked and pulsing of the drive stopped.
Drive is waiting there until Bit 0 will be switched to 1 again for running the drive.

“Off 2” and “Off 3” of Control Word STW1

- In **Control Word STW1** the **Bit 1 “Off 2”** and **Bit 2 “Off 3”** are designed for “fast” or “emergency” stop.
- If this Bits are used for a stop, the Drive remains afterwards in state “B” as conditions for stepping further are not fulfilled (either Bit 1 = 0 or Bit 2 = 0)!
- The Bit-position (status) of “Off 2” and “Off 3” could be read back (out of the Drive) with evaluating the BUS ZSW1 - there to look at the Bit 4 or Bit 5 (see page 32).
- “Off 2” or “Off 3” could be initiated (executed) by Bus-System or Digital inputs of the Drive.

Control-unit to write data to the Drive...

To control the Drives operation -> start and stop

In case you indicate an error:

Evaluate in what status the Drive is by reading the ZSW1 with “read Modbus register 0”.

In case an error has happen, you find the Drive in operating status “Fault”.

	BUS ZSW1	Bit 15	Bit 14	Bit 13	Bit 12	Bit 11	Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
G	Fault (not ready for switching on)	x	x	x	x	x	0	1	0	0	0	x	x	1	0	0	0

To start the drive now you have to “toggle” Bit # 7 by writing register 1024 (to internal Drive-buffer PZD1 -> STW 1) with the Bit-pattern where Bit 7 is first set to “0” and afterwards to “1”.

First Bit 7 = 0

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
STW 1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1

Then Bit 7 to 1

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
STW 1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Bit 7 again to 0

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
STW 1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1

The Drive changes its state to “B”

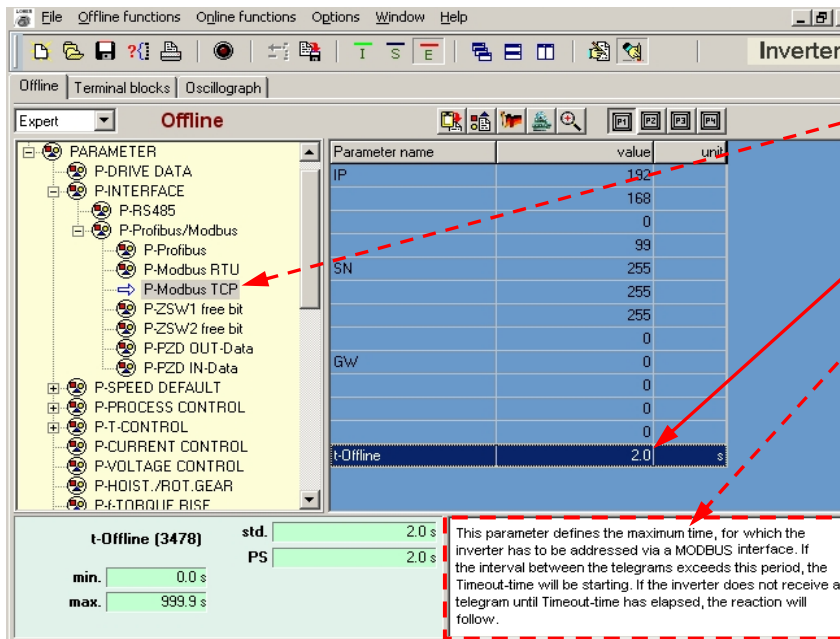
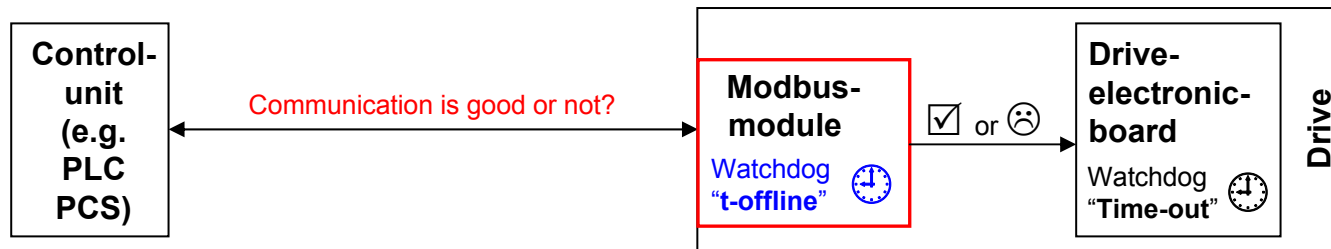
B	Switch interlock	x	x	x	x	x	0	1	0	0	1	1	0	0	0	0
---	------------------	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

From there to start by setting Bit 0 to 0 -> Drive changes to “C” and then setting Bit 0 to 1 (-> see state diagram)

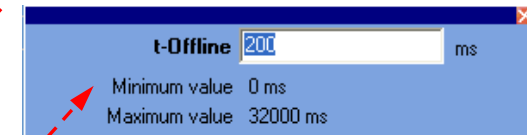
Control-unit to write data to the Drive... “t-offline” of the Drive?

Parameter “t-offline”:

- With “t-offline” the Modbus-Module is monitoring communication with the host system (independent from the drive-electronic-board!)
- For Modbus TCP the “t-offline” is re-triggered with each write-command (Code: 5, 6, 15, 16, 22, 23)
- In case there is no communication during the specified time, the communication-module generates a signal to start the “Time-out” timer
- The reaction of the Drive after “Time-out” can be selected (parameterized) with IMS using the parameter Rct. Bus
- In case the Host system is only monitoring the Drive “t-offline” is not needed (or from importance)



Selection of “t-offline”



Setting “t-offline” to 0 (zero)?

- Modbus TCP execution of...
- physical evaluation of the Ethernet-Link-Status (= evaluation Cable connected or not!)
 - no evaluation of Modbus TCP telegrams

Modbus RTU:

- no evaluation of connection
- no evaluation of telegrams

Control-unit to write data to the Drive...

“Time-out” of the Drive?

Parameter “Time-out”:

- The two independent timers “Time-out” and “t-offline” are working close together to coordinate the two in the communication involved physical hardware-components of the Drives (= communication-module and the drive-electronic-board).
- The communication-module does not link “time-information” through to the drive-system! Instead of “time” the communication-module serves the drive with a digital “good/not good” information (and saves with this pre-data-processing processor-capacity in the Drive)
- This “good/not good” information is generated by the “t-offline” timer, who is monitoring the communication-timing directly on the communication-module.
- In case the communication-module changes its information to “not good” or if **Bit10** (guide from master/AD) in the control word STW1 is not set to 1 -> the “Time-out” timer (on the drive-electronic-board) will be started.
- After elapse of the “Time-out” time the parameterized Reaction in parameter “Rct.Bus” is executed.

Selection of “Rct. BUS”

Rct. BUS	none
	Speed off
	CTRL.OFF
	Emerg. stop
	OFF 2
	Fault

Selection of “Time-out”

Time-out t	20.0	s
Minimum value	0.1	s
Maximum value	999.9	s

Rct. BUS (1274)

std.	CTRL.OFF
PS	CTRL.OFF
min.	
max.	

Determination of the FI reaction if the PROFIBUS communication fails or if Bit10 (guidance from master, AD) in the control word STW1 of the Master to FI is not set. The reaction is implied only if the "Timeout time" has elapsed and BUS is selected either as "Op.-source" and/or at "Set source" and/or at "AV-source" and by that is relevant for the guidance

Bit 10 of the STW1:

10	1	Leadership from AG	Control word and setpoint valid
	0	No leadership	Control word and setpoint frozen

If Bit 10 = 0 then...

- Changes of the control-bits and set-point-values will not be accepted by the drive!
- “Time-out” will start

Backup...

Online functionality of IMS software

The screenshot shows the 'Inverter Management Software' interface. The 'FI monitor' tab is selected and highlighted with a red box. A red arrow points from this tab to a state machine diagram. The diagram shows the drive's operational states: Mains off, Switch interlock, Fault, Rdy.f. On, Rdy.f. work, Rel.f. work, and Working. Transitions between states are controlled by various inputs like OFF 1, OFF 2, Emerg. stop, and ContrRel. The 'Working' state is highlighted in green. A legend indicates that a white circle represents a warning and a green circle represents a setpoint reached. The status is shown as 'Status (hex): 7537'.

Act. Values	value	unit
Aux-SV	194.9	Hz
f-motor	14.9	Hz
I-motor	0.0	A
T-motor	-6.8	Nm
V-motor	207	V
P-motor	-0.4	kW
DC-volts	951	V
SetVal	15.0	Hz
Speed	14.9	Hz
n-motor	449	rpm

Control buttons: ContrRel, Speed on, Reversing, Reset.

Operating source: BUS, -> PC.

Setpoint source: BUS 1, -> PC.

Setpoint default: 15.0 Hz (range: -50.0 to 50.0).

Progr. Fct.: Function 1, Function 2.

Ver. 24/26/13 R5232/485 communication: activ

Drives status:
 All statements referring to the Drive-state-machine can be monitored if you are online with the IMS software

Drive-states could be changed by setting/changing checkmarks

Actual values of the drive are visualized

Backup... Online functionality of IMS software

Drives values:

Drives Values can be displayed online in the Window of the Modbus Parameters on the very right side

Setting of the IP-Adress and other Modbus parameters:

You find this in the Parameters for the Interface!

The screenshot displays the 'Inverter Management Software' interface. The left sidebar shows a tree view of parameters under 'Online'. The main area is divided into two tables. The top table lists Modbus parameters, and the bottom table shows actual values for various motor parameters.

Parameter name	value	unit
IP	192	
	168	
	0	
	99	
SN	255	
	255	
	255	
GW	0	
	0	
	0	
t-Offline	2.0	s

Act. Values	value	unit
n-motor	314	rpm
f-motor	10.4	Hz
I-motor	0.5	A
T-motor	-2.6	Nm
V-motor	146	V
P-motor	-0.09	kW
DC-volts	1011	V
SetVal	10.4	Hz
Speed	10.4	Hz
n-motor	314	rpm

Backup... Modbus TCP/IP-Settings with the Dip-Switches

TCP/IP-settings with IMS-software:

Select "PARAMETER" -> "P-INTERFACE" -> "P-Profibus/Modbus" -> "P-Modbus TCP".

There the Parameters for IP-Address TCP/IP and Sub-Net TCP/SN as well as the Gateway TCP/GW can be selected.

TCP/IP-settings with Hardware (Dip-Switches):

To use the Hardware (Dip-Switches) you have to set the IP-Address to 0-0-0-0 (by use of the IMS-Software as described above).

In case the IP is set to 0-0-0-0 the following standards will be used by completion with the setting of the Dip-Switches:

IP-Address: 192.168.0.X (X is the value of the Dip-Switch)

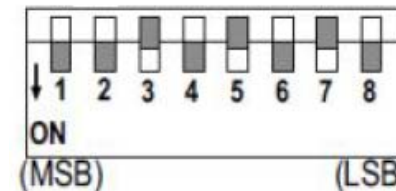
Gateway: 0.0.0.0

Subnet: 255.255.255.0

The Dip-Switches define the last Byte of the IP-Address (binary coded).

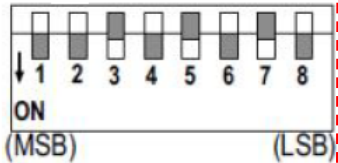
The IP-Address of the example on the right is 192.168.0.42

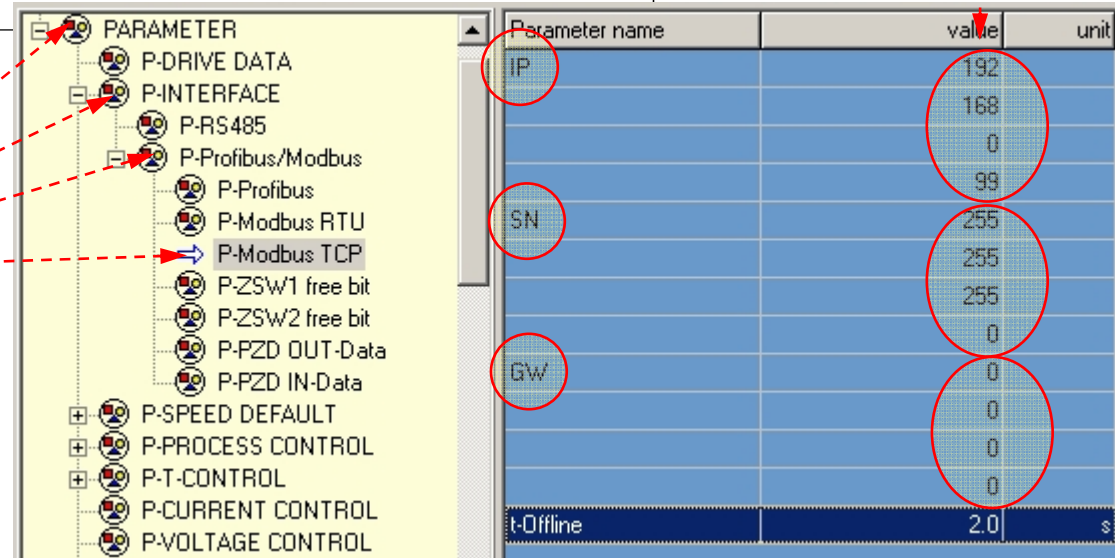
(out of 32+8+2)



Parameter name	value	unit
IP	192	
	168	
	0	
	99	
SN	255	
	255	
	255	
	0	
GW	0	
	0	
	0	
	0	
t-Offline	2.0	s

Backup... Modbus TCP/IP-Settings with the Dip-Switches

Component	Function
Dip-Switches for configuration	The Dip-Switches define the last Byte of the IP-Address
	<p><u>TCP/IP-settings with IMS-software:</u> Select "PARAMETER" -> "P-INTERFACE" -> "P-Profibus/Modbus" -> "P-Modbus TCP". There the Parameters for IP-Address TCP/IP and Sub-Net TCP/SN as well as the Gateway TCP/GW can be selected.</p> <p><u>TCP/IP-settings with Hardware (Dip-Switches):</u> To use the Hardware (Dip-Switches) you have to set the IP-Address to 0-0-0-0 (by use of the IMS-Software as described above). In case the IP is set to 0-0-0-0 the following standards will be used by completion with the setting of the Dip-Switches: IP-Address: 192.168.0.X (X is the value of the Dip-Switch) Gateway: 0.0.0.0 Subnet: 255.255.255.0</p> <p>The Dip-Switches define the last Byte of the IP-Address (binary coded). The IP-Address of the example on the left is 192.168.0.42 (out of 32+8+2)</p>



Parameter name	value	unit
IP	192	
	168	
	0	
	99	
SN	255	
	255	
	255	
	0	
GW	0	
	0	
	0	
	0	
t-Offline	2.0	s