User Manual
Automation and Telecontrol System Micro

Version 2.4

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PART I General

1 Validity Note

This user manual applies for the ALU020 from firmware version 3.30 and MULTIPROG Plus version 2.8. The current firmware version is available for download in the customer area at www.ohp.de

It is possible that some features will not be supported by older firmware versions. You can find a breakdown of the firmware versions and their new associated features in **Part II Configuration and Programming**, chapter 1.

2 Introduction

The Micro automation and telecontrol system is a freely programmable control system, with its modular I/O, it can be extended to exactly meet your I/O requirements and it has an attractive price/performance ration. The Micro is a freely configurable, field bus neutral automation platform, which is extremely flexible and can be used for a variety of applications. The controller is programmed using the IEC 61131-3 programming package MULTI-PROG.

By means of the standardised communication protocols such as IEC 60870-5-101/104, or the well-known Modbus TCP protocol the system can be integrated into a wealth of automation and telecontrol environments.

Using the optional insertable communication adapters, extremely cost-effective telecontrol stations can be created, which use GPRS, GSM, ISDN as well as analogue modems for the communication.

Using the system's finely selectable modular I/O, an exact configuration can be created including only the necessary I/O without overhead, where the system can be expanded to 512 I/O points at any time.

When space is a premium, the Micro system can be mounted on a standard DIN rail without a rack. The system requirements are hereby reduced to a minimum.

3 System Requirements

3.1 System Requirements Programming Software

Hardware

For the optimum performance when using the programming system Multiprog, the following hardware requirements must be met:

Unit/Module	Minimum	Recommendation
IBM compatible PC with Pentium processor	Pentium II 350 MHz	Pentium III 500 MHz
User memory	64 MB	128 MB
Hard disk	250 MB free memory	
CD-ROM Drive	Necessary	
VGA Monitor colour setting Resolution	 256 colours 800 x 600	 True Colour 1024 x 768
Ethernet interface	Necessary	

Software

MULTIPROG requires one of the following operating systems:

- Microsoft Windows XP, SP2

3.2 Micro System Components

The following list includes the system components for the Micro automation and telecontrol system. Apart from the central unit ALU020 and the programming software Multiprog, the I/O modules and the system accessories are especially mentioned. The I/O modules are compatible to the Wago I/O system 750/753. The Wago product numbers are included in the column Wago No..

Micro System Components			
Designation	**Wago No.**	**Description**	
		Central Unit, Programming Software	**Communication Interfaces**
ALU020-000		Central unit for the Micro System 32 MByte RAM / 32 MByte Flash Buffered ms exact RTC Optional OHP-GPS Receiver module 2xRS232 1xEthernet 100 Base T 1xFeldbus in preparation 1xMicro SD card slot 1 Modem slot for Analogue-, ISDN-, GSM-, GPRS Operating voltage 14-28V, integrated power supply	IEC 60870-5-101 IEC 60870-5-101 AWD (automatic dial-up service) IEC 60870-5-104 Modbus TCP Client/Server Modbus RTU
ALU020-002		ALU020 as above, incl. UEM002 in-house FSK two-wire modem	5 pole plug
ALU020-004		ALU020 as above r, incl. UEM004 in-house analogue modem	a/b interface
ALU020-005		ALU020 as above, incl. UEM005 ISDN modem	S0 interface
ALU020-007		ALU020 as above, incl. UEM007 GSM / GPRS modem	Aerial connection SMA-f
MULTIPROG-Plus		MULTIPROG IEC 61131-3 Programming software for the Micro with ALU020-xxx using the configuration software f0r IEC 60870-5-101 and 104 incl. OHP Add-on	IL, FBD, LD,ST, SFC, MAS Cross translation ST-IL-LD-FBD, Off-line simulation, Online-change, watch window, debug functions, project comparison, cross reference.
		Digital Inputs	**Input Voltage**
DEP002-400	753-400	2 Digital inputs	24V DC,
DEP004-402	753-402	4 Digital inputs	24V DC
DEP008-430	753-430	8 Digital inputs	24V DC
		Digital Outputs	**Output Voltage**
DAP002-501	753-501	2 Digital outputs	24V DC, 0,5A
DAP004-504	753-504	4 Digital outputs	24V DC, 0,5A
DAP008-530	753-530	8 Digital outputs	24V DC, 0,5A
		Analogue Inputs	**Input Signals**
ADU002-465	753-465	2 Analogue inputs, potentially isolated, 12Bit, 2ms	0-20mA
ADU004-453	753-453	4 Analogue inputs, potentially isolated, 12Bit, 10ms	0-20mA
ADU014-459	753-459	4 Analogue inputs, potentially isolated, 12Bit, 10ms	0-10V

Micro System Components			
Designation	**Wago No.**	**Description**	
		Analogue Outputs	**Output Signals**
DAU002-552	753-552	2 Analogue outputs, potentially isolated, 12 Bit, 2ms	0-20mA
DAU012-550	753-550	4 Analogue outputs, potentially isolated, 12 Bit, 2ms	0-10V
DAU024-557	753-557	4 Analogue outputs, potentially isolated, 12 Bit, 10ms	+/- 10V
		System Accessories	**I/O Potentials**
TERMBLOC	753-110	Plug for I/O cards	-
PWR024-602	750-602	Supply terminal for I/O potential	24V DC
PWR230-612	750-612	Supply terminal for I/O potential.	230V AC
TERM01-600	750-600	Bus termination module for I/O module.	
FIX002		End clamps for mechanical fixing on the DIN rail	
GPSRCV		GPS time receiver for the Micro, @120 and @250. Requires serial interface on the ALU, Cable length 4m	RS232, RJ45 on ALU020-xxx
KBL180		Connection cable UEM004 on a/b, length 5m	4 pole plug, TAE-N
KBL181		Connection cable UEM005 on a/b, length 5m	4 pole plug, RJ11
UEM007MA		Magnetic foot aerial incl. cable length 3m	SMA-m

The Micro automation and telecontrol system includes the following communication interfaces that can be directly operated on the ALU020. Diverse telecontrol and fieldbus protocols are available, as specified in the following list. The configuration of the communication procedures is carried out dependant on the module and procedure, either with Multiprog or with a parameter file.

4 Communication Interfaces of the Micro System

The Micro automation and telecontrol system includes the following communication interfaces that can be directly operated on the ALU020. Diverse telecontrol and fieldbus protocols are available, as specified in the following table. The configuration of the communication procedures is carried out dependant on the module and procedure, either with Multiprog or with a parameter file.

Specific communication procedures can be transmitted using UEM transmission modules via leased lines, Analogue, ISDN, GSM, or GPRS. The UEM modules are offered as external modules or also as in-house modules for the ALU020. The allocation to the individual procedures can be seen in the following table.

Overview Micro Communication Procedures

Procedure	Module	Connection	Operational-Mode	No. of Interfaces	Card / System	Connection Time Synchronisation	Configuration	Transmission-Modules
IEC 60870-5-101	ALU020	RS232	Slave	2	1	GPSRCV, Frame	Multiprog, parameter file	UEM002, -202
IEC 60870-5-101 AWD	ALU020	RS232	Slave	2	1	GPSRCV, Frame	Multiprog, parameter file	UEM300, -301, -302, -304, -004, -005,-007
IEC 60870-5-104	ALU020	Ethernet	Slave	1	1	GPSRCV, Frame	Multiprog, parameter file	UEM306, -007
Modbus TCP	ALU020	Ethernet	Server	4	1	-	Parameter file	UEM306, -310
Modbus RTU	ALU020	RS232	Slave	1	1	-	Parameter file	UEM002, -202

4.1 Modem Modules for Telecontrol Procedures

The Micro has different transmission modules available for leased lines, Analogue, ISDN, GSM, GPRS or Ethernet communication, which are listed in the following table. These modules are organised into modules mounted on TS35 DIN rails as well as open frame modules that are mounted in-house on the ALU020. The in-house modules are installed in our factory and should therefore be considered when ordering the ALU020-xxx. See the following tables.

Micro Transmission Technology with External Modules

Designation	Function	Supply
UEM202	FSK - two-wire	24V DC
UEM300/1	Analogue	24V DC
UEM302	ISDN	24V DC
UEM304	GSM	24V DC
UEM306	GSM/GPRS	24V DC

Micro Transmission Technology with In-house Modules

Designation	Function	Supply
ALU020-002	FSK - two-wire	24V DC
ALU020-004	Analogue	24V DC
ALU020-005	ISDN	24V DC
ALU020-007	GSM/GPRS	24V DC

4.2 Connection via Modbus

4.2.1 Modbus RS232 Slave / Modbus TCP-Server

One of the serial interfaces of the ALU020 can be configured as a Modbus slave interface.

The Modbus TCP server is coupled via the Ethernet interface.

Apart from the selection of the interface (Serial or TCP-IP) the configuration of both is identical.

The following function codes are supported by the ALU020.

FC 1 Read Coils
FC 2 Read Discrete Inputs
FC 3 Read Holding Register
FC 4 Read Input Register
FC 5 Write Single Coil
FC 6 Write Single Register
FC 15 Write Multiple Coils
FC 16 Write Multiple Register
FC 23 Read/Write Multiple Register

The data is made available in the shared memory area. The configuration is made using the INI files and is stored on the Micro SD card.

Beware: The FC 2 and FC 4 functions do not directly affect the inputs of the hardware. The inputs must also be depicted here in the shared memory area.

Beware: The Modbus TCP server supports a maximum of 4 client connections. It should be noted here that the Modbus client of an @120 or @250 each creates one connection for reading and one for writing data. The number of the transactions (simultaneously transmitted inquires in asynchronous operation) is limited to 4.

For additional information see **Part II Configuration and Programming,** chapters 5.3, 5.4 and 5.6.

PART II Configuration and Programming

1 New Performances of the ALU020 Firmware

Version 3.00

Series release

Version 3.10

- Use of PROCONOS4 for the online change function
- IEC101 AWD - Initstrings adapted
- IEC101 AWD - Time monitoring (TOUT) adapted

Version 3.25

- RAS service without VPN (when VPN is established by the provider).
- With GPRS transmission a third waiting time on unsuccessful connection establishment when the connection is not possible due to long-standing faults (e.g. failure of the DSL router on the opposite side).
- Modbus TCP/IP and serial integrated.

Version 3.26

- Forced disconnection during GPRS operation reworked.

Version 3.30

- System time now in millisecond resolution.
- Due to the overload performance of the Modbus TCP/IP restricted to 6 requests per server call.

2 Creating a New Project with Multiprog

When creating a new project proceed as follows:

Step 1 In the File menu select "New Project…"

Step 2 Double click the presentation " Micro_A020".

Step 3 If necessary, change the IP-address for connecting to the ALU020 (Part II, chapter 3).

Step 4 Save the project with its project name using the File menu "Save project as…".

Step 5 Undertake the definition of the inputs and outputs using the I/O configurator (Part II, chapter 4).

Step 6 When the IEC 60870-5-101 or -104 communication protocol is used, create the parameter file and the standard user program using the PLC configurator.

Step 7 Create a Logical Program Unit (POE) or extend the automatically created standard user program.

Step 8 Enter the created POEs into the task execution list.

Step 9 Generate the program code (F9 or menu "Code -> Make").

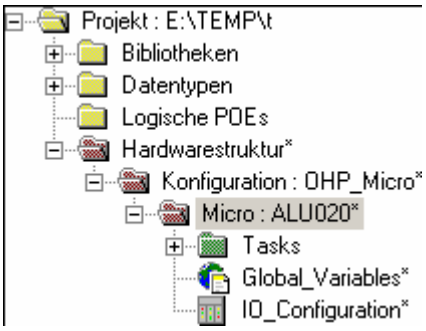
Step 10 Using the menu "Online -> Project Control" send the program code to the ALU020 and start.

Beware: Pay attention that the assignment of hardware and software addresses in the program as words always begin with an even byte address. The same applies for double words. Here the base addresses must however always be dividable by 4.

Affected here are:

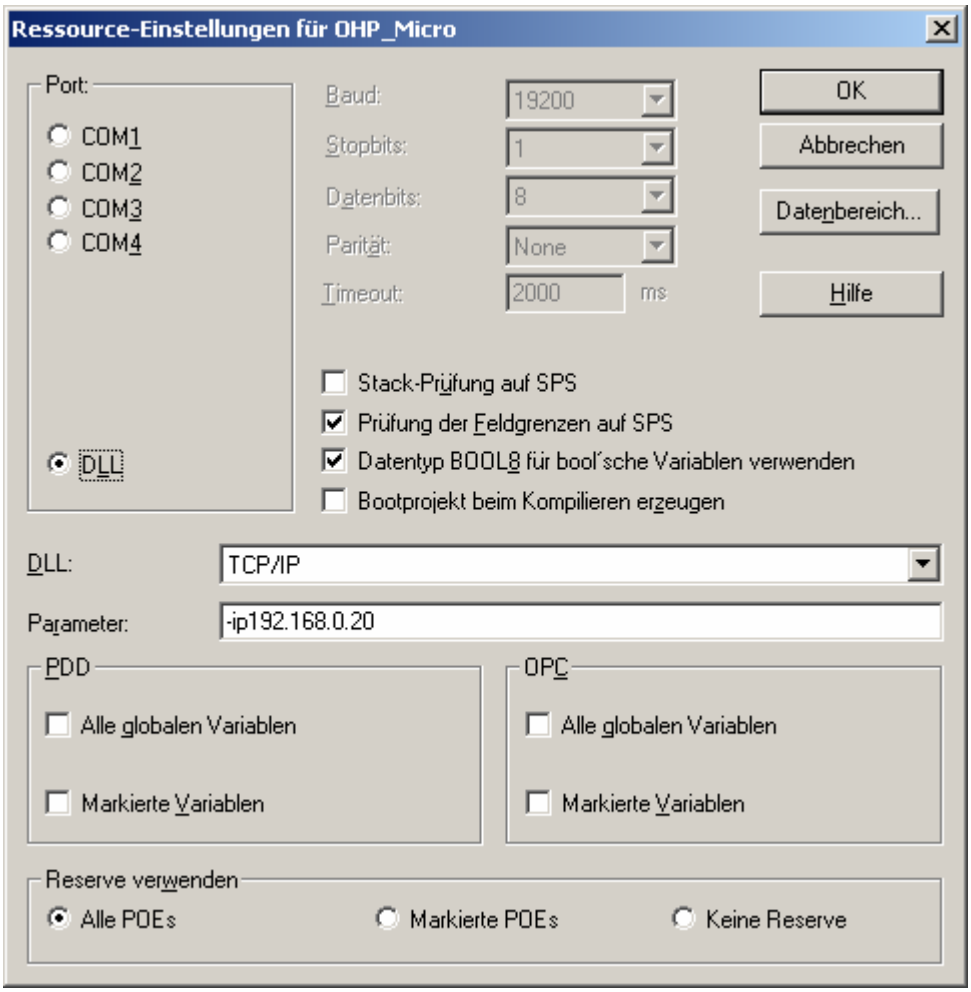
- Base addresses with ADUxxx (%IB0, %IB2 %IB4 etc.)
- Base addresses with DAUxxx. (%QB0, %QB2 %QB4 etc.)
- Transfer addresses with IEC communication for set values (%IW0, %IW2 etc.), measured values (%QW0, %QW2 etc.), bitstrings and counter values (%QD0, %QD4 etc.)
- Word / double word assignment with Modbus coupling (e.g. %MW3.0000, %MW3.0002, %MD3.0004, %MD3.0008 etc.)

3 Change the IP Address for the Connection to the ALU020



Using the right-hand mouse button, select the resource in the example Micro:A020,. Open the pop-up window and select the "Settings… " dialogue.

Change the IP-Address in the Parameter box.



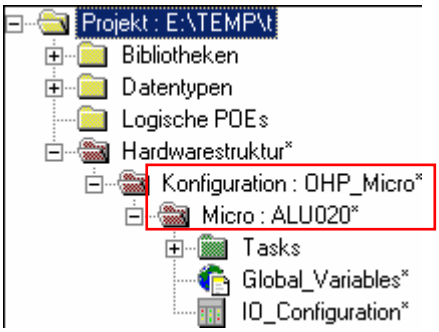
4 Definition of the Inputs and Outputs

4.1 Inputs and Outputs with OHP's PLC Configurator

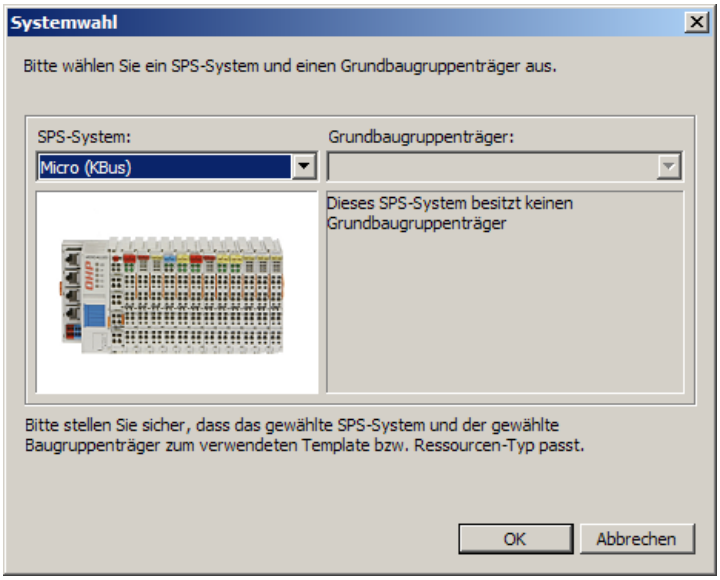
Provided you have installed Multiprog from the OHP installation CD including the OHP add-ons, then the new PLC Configurator is available. If this is not the case, please proceed using the description in Part II, Chapter

With the help of the new PLC Configurator editor the user can quickly and conveniently create the I/O configuration.

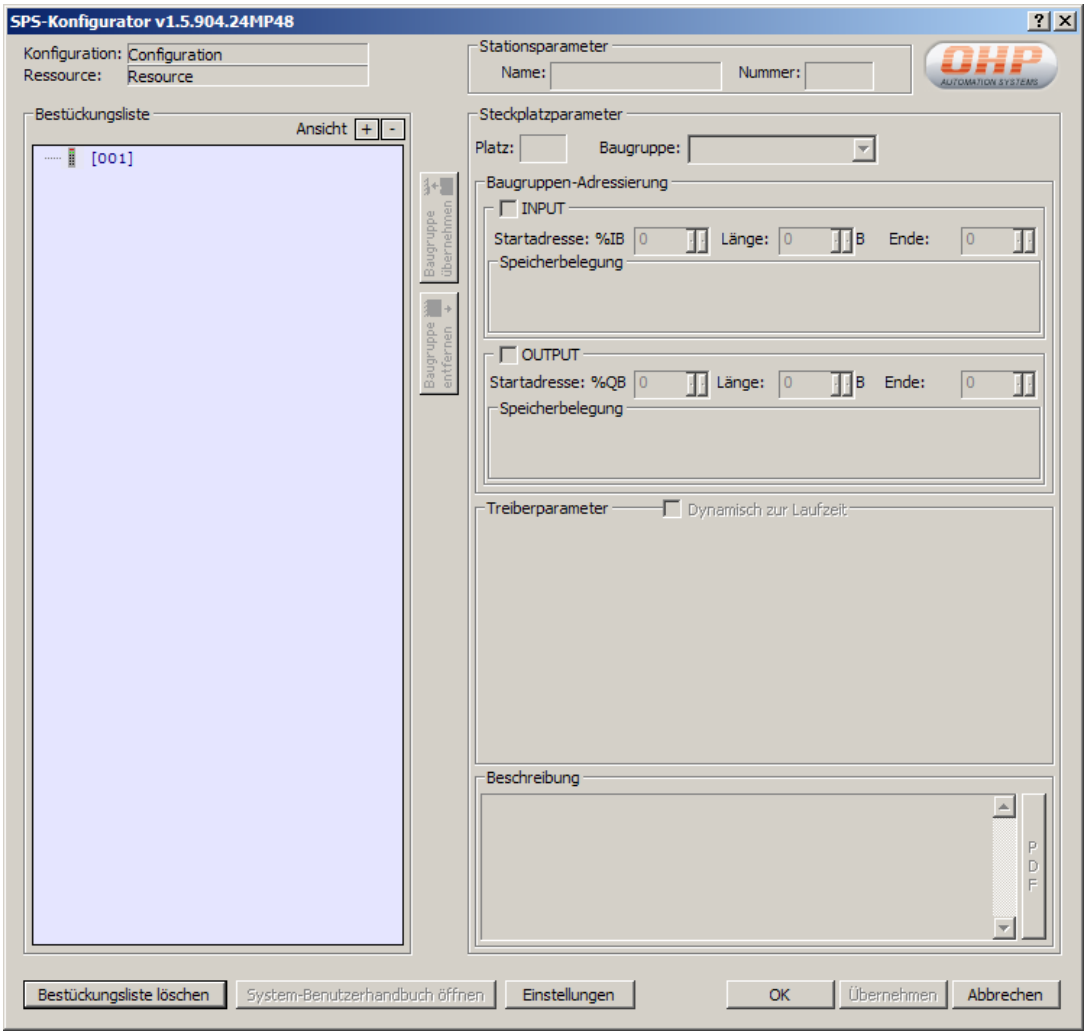
One click on the selection button in the menu bar and the "PLC Configuration" dialogue will be opened for the PLC configuration. Because the PLC is represented in the Multiprog project tree by one configuration node and one subordinate node, the selection is carried out under the corresponding designated node.



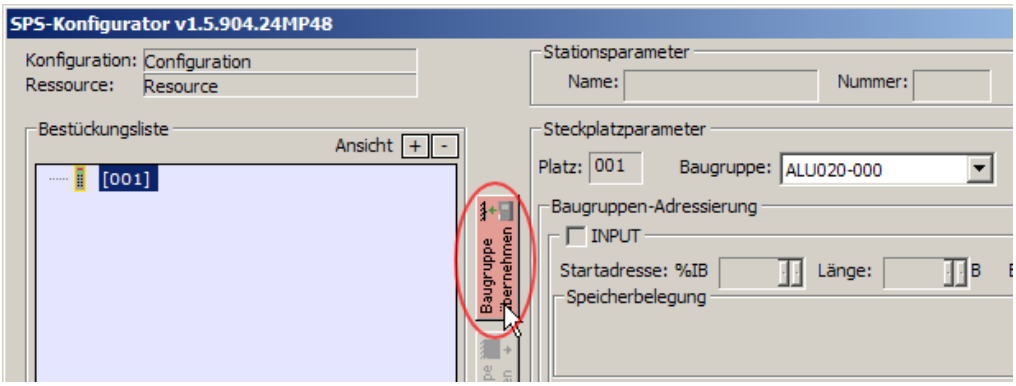
After selecting the configuration and the resource and clicking the „OK" button the existing equipment list will be opened. When no equipment list exists, then the dialogue "System selection" will appear.



For the Micro system resource is selected here, click on the “OK” button and the equipment list will be opened.



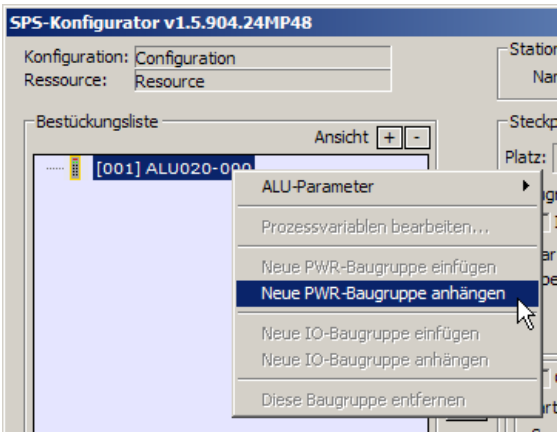
In the first slot [001] only an ALU020 can be inserted, which is automatically entered in the module field.



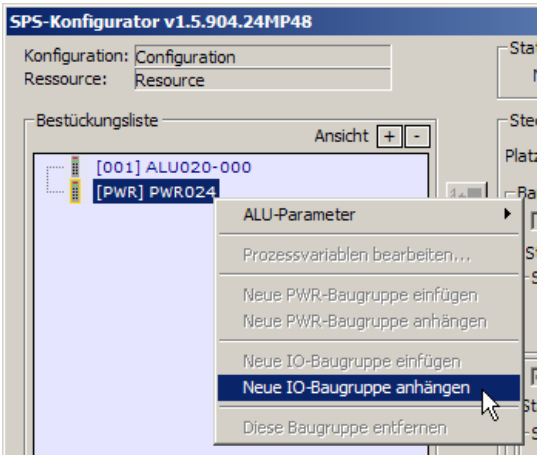
After clicking on the button “Accept module“, the ALU020 will be entered in slot [001].

4.1.1 Inserting Modules

To insert further modules, firstly a supply module (PWR module) must be inserted. To do this, press the right mouse button on the ALU in the context menu and the command “Attach a new PWR module” can be selected.



After inserting the PWR module, a new I/O module can be selected again from the context menu:



The generated logical slot in this instance has the number 2, because the PWR module itself occupies no logical address.

After clicking on the slot with the left mouse button, the desired module can be selected from the drop down box in the right-hand side of the editor window. A click on “Accept module” assigns the module to the selected slot.

Using the context menu further I/O or supply modules can be inserted in a similar way.

4.1.2 Removing Modules

Modules can also be removed using the context menu, which is done by clicking the module with the right-hand mouse button. When removing a module, the logical slot address of the following module will be automatically decremented, because the PLC system doesn't allow "gaps".

4.2 Slot Parameter

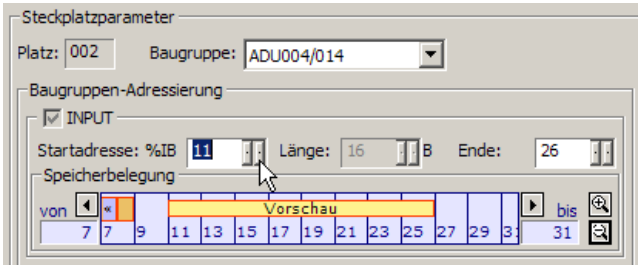
In the right part of the dialogue under the module selection box, the parameters for the selected module are determined.

4.2.1 Module Addressing

In this field you can undertake the addressing of the I/O memory for the selected module. According to the type the module will be displayed in the corresponding configuration area.

For input modules (e.g. DEP, ADU) a free section of in the input memory, for output modules (e.g. DAP, DAU) a free section of in the output memory will be automatically suggested. The area can be shifted, but the width cannot be changed. The address area can be shifted using the buttons provided (see diagram), either the start or end address can be changed.

Overlapping of the addressing memory already reserved for other modules is not permissible. For a better overview, the new and already occupied memory area is graphically displayed in the group box “Memory occupation”.



In the adjacent diagram the input memory area for an ADU004/014 is assigned to the start address %IB0. Because of the fixed memory-width of 16 Bytes, the end address is at %IB26.

Note: A change e.g. to the start address must always be confirmed using the “Accept module“ button, only then is the module activated. It is imperative that the ADUxxx and DAUxxx modules are assigned with even Byte addresses.

4.2.2 Driver Parameter

For modules that require an extended configuration, the corresponding dialogue is displayed in the group box „Driver parameter“. Currently, the Micro system has no modules that are configured in this way.

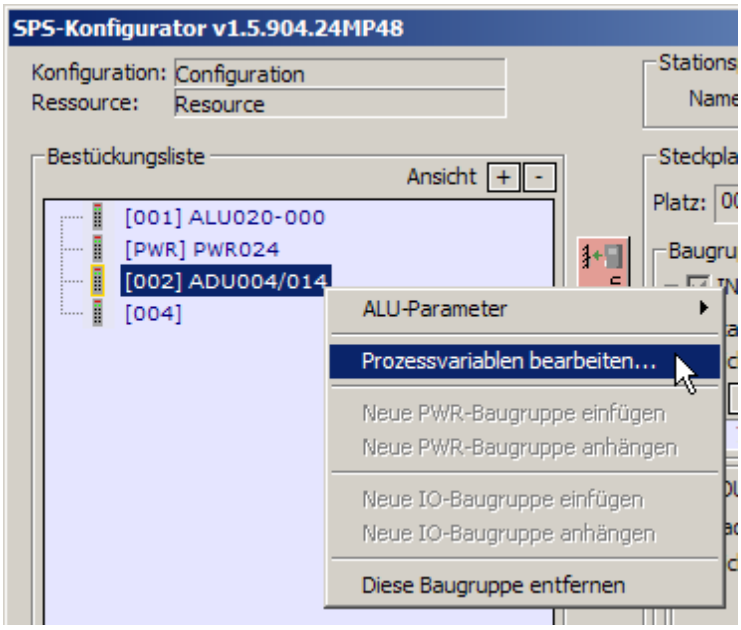
4.2.3 Description

In the „Description“ field a summarised description of the selected module and its configuration is displayed.

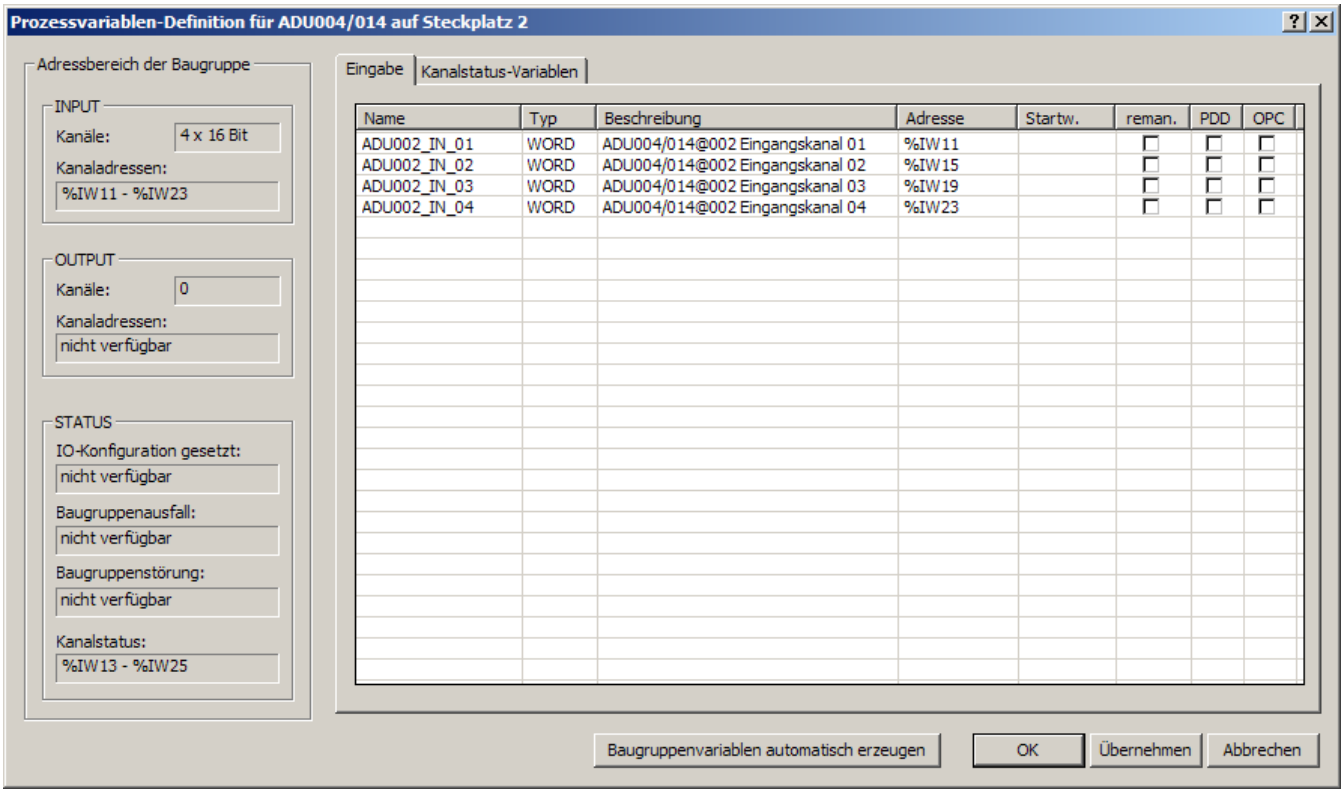
If a PDF document for the module exists, the PDF button will be activated. Using this the corresponding document will be displayed. For this, the free-of-charge program “Adobe Acrobat Reader” (at least version 5.0) must be installed on the programming unit.

4.3 Configuring Module Variables

Via the context menu the process variables including the corresponding I/O address for each module can be assigned.



After selecting the menu point “Edit process variables” the corresponding dialogue will be displayed.



The I/O configuration is displayed in the left part of the dialogue box. In the depicted case there is an ADU004/014 with 4 input channels each with 16 bits. Furthermore each module has a status word for each channel, which indicates the status (overload, etc.).

Using the button “Create module variables automatically”, each input and its status will be automatically assigned with a global variable. The table can be randomly modified; a mouse click on the line starts the editing mode. The dialogue must be confirmed using “OK” or “Apply” so that the change from the editor is accepted.

4.4 Accept the Configuration

The configured PLC system must be must be confirmed using the “OK” or “Apply” button in the main dialogue. Only then does the editor make the corresponding changes to the Multiprog I/O configuration or the global variable configuration.

5 Configuration of the Initialisation Files

5.1 Settings in the ALU020.INI

The ALU020.INI file can be found in the root directory of the CF card. This file contains the settings regarding the IP address and various services for access to the ALU020.

```
#ALU020:  (GEN)

[IP]
ADDRESS             = 192.168.0.20
NETMASK             = 255.255.255.0
DHCP                = 0

[FTP]
ENABLE              = 1

[TELNET]
ENABLE              = 1

[TIME-GPS-NMEA]
ENABLE              = FALSE
PORT                = 2
BAUD                = 4800          # should not be changed
REFRESH             = 60            #  in minutes
```

5.1.1 Setting the IP Address on the ALU020

ADDRESS and NETMASK must always be entered. When you are operating the ALU020 via a gateway, you can extend the file as follows.

Example:

ADDRESS= 192.168.101.101
NETMASK= 255.255.255.0
GATEWAY= 192.168.101.1

Provided you have changed the file via an FTP access, you must cycle the ALU020 by switching it off and on again, only then is the data adopted.

5.1.2 Access via FTP or TELNET

The entries [FTP] und [TELNET] make access to the ALU possible with the corresponding services. When you want to prohibit this access then set the ENABLE =0.

Caution: When you deactivate the FTP access, you can only modify the INI files on the ALU 320 using a card reader.

5.1.3 Time Synchronisation using GPS

Parameter under [TIME-GPS-NMEA]

If the parameters **ENABLE** is set to TRUE, then a time synchronisation of the ALU020 can take place via a GPS receiver.

PORT defines the COM interface (1 or 2) to which the receiver is connected.

BAUD defines the transmission rate with which the receiver transmits the data to the ALU020. This entry must not be changed.

REFRESH defines the time interval in minutes (1…60) after which the system clock is synchronised by the GPS receiver. During this time a number of time signals are received by the GPS receiver, however the system clock

will only be updated after the set time has elapsed and is synchronised by the next valid time signal. After each successful time synchronisation the refresh timer is reset. Also see chapter 7.1.

5.2 Settings in the ALURAS.INI

Configuration using PLC Configuration "ALU Parameter –> Edit basic settings -> GPRS VPN Settings"", transfer per FTP.

Caution: Most of the following parameters described below must not be changed. The relevant settings required for individual configurations are prompted by the PLC configuration in Multiprog. Please use the PLC configuration exclusively for editing the file. OHP GmbH cannot guarantee trouble-free operation due to inappropriate changes made to these settings

```
[AXRASVPN-PARAMS]
PPPDisconnect= FALSE
PPPDisconnect3Att= FALSE
RedialWTimeMS= 5000
FailRedialWTimeMS= 5000
ReConnectWTimeMS= 5000
FailReConnectWTimeMS= 5000
PPPLogoutLoginMode= 1
PPPLogoutLoginWTimeSec= 60
PPPLogoutLoginAt= 12:00:00
PPPCheckWtimeSec= 3600
HwReset3Att= TRUE

[AXRASVPN-PARAMS-T2]
VPNDisable= FALSE
DialRetry= 0
DialRetryWTimeMin= 0
VpnRetry= 0
VpnRetryWTimeMin= 0

[DIAL-LOCATION]
LOCAL= G
DISTANCE= G
INTERNATIONAL= G
AREA=
COUNTRY= 49
DIALTONE= FALSE
DISABLE-WAITING= TRUE
```

```
WAITING-CMD=

[RASMODEM]
Baudrate= 19200
Parity= NO
DataBits= 8
Stopbits= ONE
FlowCtrl= HARD
CancelTime= 120
DialWaitTime= 0
DialCmdOpt= +CGDCONT=1,"IP","internet.t-mobile"

[ISP-PPP-DIAL]
ComPort= 1
CountryCode= 49
AreaCode= 60
LocalPhoneNumber= *99***1#
DialAsLocalCall= FALSE

[ISP-PPP-TCPIP]
IpHeaderCompression= FALSE
SwCompression= FALSE
Slip= FALSE
SpecificIpAddr= FALSE
IpAddr= 0.0.0.0
NameServers= FALSE
ipaddrDns= 0.0.0.0
ipaddrDnsAlt= 0.0.0.0
ipaddrWins= 0.0.0.0
ipaddrWinsAlt= 0.0.0.0

[ISP-PPP-SECURITY]
RequireDataEncryption= FALSE
PAP= FALSE
CHAP= FALSE
MsCHAP= FALSE
```

```
MsCHAP2= FALSE

[ISP-PPP]
UserName=t-mobile
Password=tm
Domain=

[ISP-PPP-PARAMS]
AllowSuspend= 0
AlwaysRequestDNSandWINS= 0
AlwaysSuggestIpAddr= 0
AuthMaxTries= 16
AuthMaxFailures= 3
CryptTypesSupported= 64
MaxConfigure= 16
MaxFailure= 5
MaxTerminate= 2
RestartTimer= 3

[VPN-PPTP]
Hostname= 123.123.123.123
UserName=Beispiel
Password=123456
Domain=

[VPN-PPTP-TCPIP]
IpHeaderCompression= TRUE
SwCompression= FALSE
Slip= FALSE
SpecificIpAddr= FALSE
IpAddr= 0.0.0.0
NameServers= FALSE
ipaddrDns= 0.0.0.0
ipaddrDnsAlt= 0.0.0.0
ipaddrWins= 0.0.0.0
ipaddrWinsAlt= 0.0.0.0
```

```
[VPN-PPTP-SECURITY]
RequireDataEncryption= TRUE
PAP= FALSE
CHAP= FALSE
MsCHAP= FALSE
MsCHAP2= TRUE

[VPN-PPTP-PARAMS]
TcpPortNumber= 1723
UdpPortNumber= 47
MaxWanEndpoints= 5
MaxTransmit= 32
InactivityIdleSeconds= 60
AlwaysEcho= 1
TunnelConfig= 0
TcpDisconnectTimeout= 30
TcpConnectTimeout= 30

[UNIMODEM-INIT]
Init1= AT<cr>
Init2= AT&FE0V1&C1&D2<cr>
Init3=
Init4=
```

5.2.1 Setting the Parameter Set [AXRASVPN-PARAMS]

PPPDisconnect

The GPRS provider communication disconnects and reconnects after every abortive VPN server login attempt. Range: TRUE / FALSE.

PPPDisconnect3Att

The GPRS provider communication disconnects and reconnects after three abortive VPN server login attempts. Range: TRUE / FALSE.

Note: Is PPPDisconnect3Att=FALSE and PPPDisconnect=TRUE, then PPPDisconnect3Att=TRUE will be automatically set.!

RedailWTimeMS

Waiting time in milliseconds between a dial-up attempt to the GPRS provider (see also the graphic of waiting time basic principles). Range: 5000 - 1342177727

FailRedialWTimeMS

Waiting time in milliseconds between three dial-up attempts to the GPRS provider (see also the graphic of waiting time basic principles). Range: 5000 - 1342177727

ReConnectWTimeMS

Waiting time in milliseconds between dial-up attempts to the VPN server (see also the graphic of waiting time basic principles). Range: 5000 - 1342177727

FailReConnectWTimeMS

Waiting time in milliseconds between three dial-up attempts to the VPN server (see also the graphic of waiting time basic principles). Range: 5000 - 1342177727

PPPLogoutLoginMode

Mode GPRS forced disconnection. Default = 1
0: off (no forced disconnection)
1: Disconnection at a predetermined time
2: Disconnection after a predetermined time interval

PPPLogoutLoginWTimeSec

Duration of the GPRS forced disconnection in seconds. Default 60 seconds

PPPLogoutLoginAt

Time or time interval of the GPRS forced disconnection (dependant on the parameter *PPPLogoutLoginMode*). Format: hh:mm:ss

PPPCheckWtimeSec

Monitoring interval GPRS traffic in seconds. If during this time no data has been transmitted via the GPRS connection, the GPRS communication will be disconnected and reconnected.

HwReset3Att

Determines whether a hardware reset of the modem will be carried out after a third unsuccessful GPRS dial-up attempt. Range: TRUE / FALSE. Default=TRUE.

5.2.2 Setting of the Parameter Set [AXRASVPN-PARAMS- T2]

VPNDisable

Determines whether a VPN tunnel should be established. Range: TRUE / FALSE. Default = FALSE.

DialRetry

Number of consecutive unsuccessful GPRS dial-up attempts after the waiting time "DialRetryWTimeMin" [minutes] has elapsed. Generally, after this time the optional parameter "HwReset3Att" will be checked. Range: 3…63. values lower than 3 mean off. Default = 0.

DialRetryWTimeMin

Waiting time in minutes after "DialRetry" unsuccessful dial-up attempts to the GPRS provider.
Range: 5 - 1440 min. Default = 5.

VpnRetry

Number of consecutive unsuccessful login attempts to a VPN server after the waiting time "DialRetryWTimeMin" [minutes] has elapsed. Generally, after this time the optional parameter "HwReset3Att" will be checked. Range: 3…63. values lower than 3 mean off. Default = 0.

VpnRetryWTimeMin

Waiting time in minutes after "VpnRetry" unsuccessful login attempts on the VPN server
Range: 10 - 1440 min. Default = 10.

5.2.3 Setting of the Parameter Set [DIAL-LOCATION]

LOCAL

External access code for local calls. Range: G, E, F. Default = G.

DISTANCE

External access code for long distance calls. Range: G, E, F. Default = G

INTERNATIONAL

External access code for international calls. Range: G, E, F. Default = G

AREA

Dialling code. Range: alphanumeric characters.

COUNTRY

International dialling code. Range: alphanumeric characters. Default =49.

DIALTONE

Dialling method. Default = TRUE.

TRUE: Frequency dialling (MFV),
FALSE: Impulse dialling

DISABLE-WAITING

Disable the following WAITING-CMD. Range: TRUE / FALSE. Default=TRUE.

WAITING-CMD

LASS code (Local Area Signalling Services) or/and user defined Calling Feature Control Codes:
e.g. *70 ... deactivate call waiting.
Range: Free or ASCII characters. Default = free.

5.2.4 Setting of the Parameter Set [RASMODEM]

Baudrate

Speed of the RS232 interface to GPRS modem. Setting = 19200.

Parity

Parity of the RS232 interface to GPRS modem: Setting = NO (no parity bit)

DataBits

Number of data bits RS232interface to GPRS modem. Setting = 8.

Stopbits

Number of stop bits RS232 interface to GPRS modem. Setting ONE (1 stop bit)

FlowCtrl

Data flow control RS232 interface to GPRS modem. Setting = HARD (hardware)

CancelTime

Time in seconds, after which the GPRS dial-up will be discontinued, if no connection is achieved.

Setting = 120.

DialWaitTime

Waiting time for a dialling tone in seconds. Setting = 0 (off).

DialCmdOpt

PDP context with APN (Access Point Name) of the GPRS provider.

The APN of the corresponding providers must be entered here (last field). This will be advised of this when e.g. you have signed a special contract, by which the provider establishes a VPN tunnel. Standard APN can be found on the website of your provider.

Default = +CGDCONT=1,"IP","internet.t-mobile".

5.2.5 Setting of the Parameter Set [ISP-PPP-DIAL]

ComPort

Number of the GPRS serial connection on the modem. With the ALU020 including integrated modem it is always COM3.

CountryCode

International dialling code. Range: No entry or alphanumeric characters. Default = 49 (Germany).

AreaCode

Dialling code. Range: No entry or alphanumeric characters.

LocalPhoneNumber

GPRS dial-up number (dependant on the GPRS provider). Setting = *99***1#.

DialAsLocalCall

Range: TRUE/FALSE . Default = FLASE.

5.2.6 Setting of the Parameter Set [ISP-PPP-TCPIP]

IpHeaderCompression

Activated IP header compression on the GPRS connection level. Range: TRUE/FALSE. Default= FLASE.

SwCompression

Activated software compression on the GPRS connection level. Range: TRUE/FALSE. Default= FLASE.

Slip

Activated *Serial Line Internet Protocol* on the GPRS connection level.
Range: TRUE/FALSE. Default= FLASE.

SpecificIpAddr

Determines whether a special IP address should be used,
Range: TRUE/FALSE. Default= FLASE.

IpAddr

Determines the IP address for the GPRS connection. If *SpecificIpAddr=FALSE* this parameter will be ignored.

NameServers

Determines if special IP addresses should be used for the name resolution on the GPRS level.
Range: TRUE/FALSE. Default= FLASE.

ipaddrDns

IP address of the DNS server (will be ignored if *NameServers=FALSE*)

ipaddrDnsAlt

Alternative IP address of the DNS server (will be ignored if *NameServers=FALSE*)

ipaddrWins

IP address of the WINS server (will be ignored if *NameServers=FALSE*)

ipaddrWinsAlt

Alternative IP address of the WINS server (will be ignored if *NameServers=FALSE*)

5.2.7 Setting of the Parameter Set [ISP-PPP-SECURITY]

RequireDataEncryption

Determines if it is compulsory that the GPRS provider must offer data encryption. Range: TRUE/FALSE. Default= FLASE.

PAP

Determines if the Password Authentication Protocol (PAP) will be accepted on the GRPS connection level. Range: TRUE/FALSE. Default= FLASE.

CHAP

Determines if the Challenge Handshake Authentication Protocol (CHAP) will be accepted on the GRPS connection level. Range: TRUE/FALSE. Default= FLASE.

MsCHAP

Determines if the Microsoft Challenge Handshake Authentication Protocol (MSCHAP) will be accepted on the GRPS connection level Range: TRUE/FALSE. Default= FLASE.

MsCHAP2

Determines if the Microsoft Challenge Handshake Authentication Protocol Version 2.0 (MSCHAPv2) will be accepted on the GRPS connection level Range: TRUE/FALSE. Default= FLASE.

5.2.8 Setting of the Parameter Set [ISP-PPP]

UserName

GPRS user name (dependant on the GPRS provider). Must not be entered for all providers.
Range: Free or maximum 16 ASCII characters. Default = t-mobile

Password

GPRS password (dependant on the GPRS provider). Must not be entered for all providers.
Range: Free or maximum 16 ASCII characters. Default = tm.

Domain

GPRS registration domain. Must not be entered for all providers.
Range: Free or maximum 16 ASCII characters. Default = <free>.

5.2.9 Setting of the Parameter Set [ISP-PPP-PARAMS]

AllowSuspend

Determines the interruption behaviour of the driver. To allow the automatic interruption of a PPP connection the entry must be set to 1.
Range: TRUE/FALSE. Default = FALSE.

AlwaysRequestDNSandWINS

Determines if the client DNS and WINS request addresses from the server, even if static addresses are entered. Range: TRUE/FALSE. Default = FALSE.

AlwaysSuggestIpAddr

If the setting is TRUE, the client will always suggest an IP address, even when a static address is not defined. If the setting is FALSE, the client requests the IP address from the server.
Range: TRUE/FALSE. Default = FALSE.

AuthMaxTries

Maximum number of attempts of the Windows CE RAS server takes to authenticate the client.
Range: 1…16. Default =16.

AuthMaxFailures

Determines the maximum number of unsuccessful authentication attempts, before the Windows CE RAS server disconnects the communication. Range: 1…3. Default = 3.

CryptTypesSupported

Supports encryption procedures. Default = 64.

0..encryption deactivated

32..activates 40-Bit MPPE encryption

64.. activates 128-Bit MPPE encryption

96.. activates 40-Bit and 128-Bit MPPE encryption

MaxConfigure

Determines the maximum number of Configure Request (CR) packages, that were not confirmed with a Configure ACK, Configure No Acknowledgement (NAK) or Configure Reject, after which it can be safely assumed that the remote station will not answer. Range: 1…16. Default =16.

MaxFailure

Determines the maximum number of Configure NAK packages, that have not been confirmed by a Terminate ACK, after which it can be safely assumed that the configuration does not coincide. Range: 1…5. Default =5.

MaxTerminate

Determines the maximum number of Terminate Request packages, that have not been confirmed by a Terminate ACK, after which it can be safely assumed that the remote station will not answer. Range: 1…5. Default =2.

RestartTimer

Determines the waiting time in seconds, before an unsuccessful Configure Request or Terminate Request is repeated, after which it can be safely assumed that the remote station will not answer. Range: 1…16. Default =16.

5.2.10 Setting of the Parameter Set [VPN-PPTP]

Hostname

IP address of the VPN servers. Range: IP address

UserName

VPN user name. Range: max. 16 ASCII characters

Password

VPN password: Range: ASCII characters

Domain

VPN registry domain. Range: ASCII characters

5.2.11 Setting of the Parameter Set [VPN-PPTP-TCPIP]

IpHeaderCompression

Activates IP Header Compression on the VPN connection level. Range: TRUE/FALSE. Default= TRUE.

SwCompression

Activates software compression on the VPN connection level. Range: TRUE/FALSE. Default= FLASE.

Slip

Activates *Serial Line Internet Protocol* on the VPN connection level.
Range: TRUE/FALSE. Default= FLASE.

SpecificIpAddr

Determines if a special IP address should be used on the VPN connection level.
Range: TRUE/FALSE. Default= FLASE.

IpAddr

Determines the IP address for the VPN connection level. If *SpecificIpAddr=FALSE* this parameter will be ignored.

NameServers

Determines if special IP addresses should be used for the name resolution on the VPN connection level.
Range: TRUE/FALSE. Default= FLASE.

ipaddrDns

IP address of the DNS server on the VPN connection level. (will be ignored if *NameServers=FALSE*)

ipaddrDnsAlt

Alternative IP address of the DNS server on the VPN connection level. (will be ignored if *NameServers=FALSE*)

ipaddrWins

IP address of the WINS server on the VPN connection level. (will be ignored if *NameServers=FALSE*)

ipaddrWinsAlt

Alternative IP address of the WINS server on the VPN connection level. (will be ignored if *NameServers=FALSE*)

5.2.12 Setting of the Parameter Set [VPN-PPTP-SECURITY]

RequireDataEncryption

Determines if it is compulsory that the VPN server must offer data encryption. Range:
TRUE/FALSE. Default= TRUE.

PAP

Determines if the password authentication protocol (PAP) should be accepted on the VPN connection level.
Range: TRUE/FALSE. Default= FLASE.

CHAP

Determines if the challenge handshake authentication protocol (CHAP) should be accepted on the VPN connection level. Range: TRUE/FALSE. Default= FLASE.

MsCHAP

Determines if the Microsoft challenge handshake authentication protocol (MSCHAP) should be accepted on the VPN connection level. Range: TRUE/FALSE. Default= FLASE.

MsCHAP2

Determines if the Microsoft challenge handshake authentication protocol Version 2.0 (MSCHAPv2) should be accepted on the VPN connection level. Range: TRUE/FALSE. Default= FLASE.

5.2.13 Setting of the Parameter Set [VPN-PPPT-PARAMS]

TcpPortNumber

TCP port number of the VPN server's PPTP access. Range: 1…65535. Default 1723

UdpPortNumber

UDP port number of the VPN server. Range: 1…65535. Default 47

MaxWanEndpoints

Maximum number of PPTP sessions. Default 5.

MaxTransmit

Maximum number remaining PPTP send packets. Default 32.

InactivityIdleSeconds

Timeout interval in seconds, after which a CCP packet (control channel packet) will be sent to the VPN server if during this time no packet has been transmitted via the tunnel. Default = 60.

AlwaysEcho

Range: 0/1. Default = 1 (switches the Echo-Modus on).

TunnelConfig

Determines the routing configuration for the client's tunnels. The value should be set to 0.

TcpDisconnectTimeout

Determines the maximum waiting time for the acknowledgement a disconnection on the TCP level. Default = 30.

TcpConnectTimeout

Determines the time-out time for a TCP connection. Default = 30.

5.2.14 Setting of the Parameter Set [UNIMODEM-INIT]

Init1, Init2, Init3, Init4

The complete configuration of the internal modem is carried out using AT commands, which are sent to the modem by the operating system in the form of initialisation strings, a number of strings commands can be sent consecutively. Each string commences with AT and ends with <cr>.

AT&FE0V1&C1&D2<cr>

&F Load factory settings

E0 Deactivate echo

V1 Reporting in text form

&C1 DCD indicates, that a connection has been established and synchronised.

&D2 After a falling edge of the DTR is detected the communication will disconnected.

5.2.15 Configuration Example

Parameter Set [AXRASVPN_PARAMS]

RedialWTimeMS= 15000	// Start a new ISP dial-up attempt every 15 seconds.
FailRedialWTimeMS= 105000	// But after 3 unsuccessful ISP dial-up attempts, wait 105 seconds.
ReConnectWTimeMS= 120000	// Start a new VPN dial-up attempt every 120 seconds.
FailReConnectWTimeMS= 1800000	// But after 3 unsuccessful VPN dial-up attempts disconnect the ISP-connection and wait 30 minutes.

Parameter set [AXRASVPN_PARAMS-T2]

.

DialRetry=9	// After a total of 9 unsuccessful ISP dial-up attempts…
DialRetryWTimeMin=5	// …firstly wait for 5 minutes
VpnRetry=9	// After a total of 9 unsuccessful VPN dial-up attempts…
VpnRetryWTimeMin=480	// … firstly wait for 480 minutes (8 hours).

Waiting time for the dial-up connection: Modem to GPRS – provider

Unsuccessful dial-up attempts	1	2	3	4	5	6	7	8	9	10
Time		ts	ts	tb	ts	ts	tb	ts	ts	tdr

ts = RedialWTimeMS tb = FailRedialWTimeMS tdr = DialRetryWTimeMS

Waiting time for the dial-up connection: VPN client (ALU) – VPN server (router)

Unsuccessful dial-up attempts	1	2	3	4	5	6	7	8	9	10
Time		tnc	tnc	trc	tnc	tnc	trc	tnc	tnc	tvr

tnc = ReConnectWTimeMS trc = FailReConnectWTimeMS tdr = VpnRetryWTimeMin

5.3 Configuration of the Shared Memory Area for Modbus RS232-Slave / TCP-Server

The ALU020 has a total available shared memory area of 16kB (MB3.0000 to MB3.16383). This area or parts thereof can be reserved for the Modbus slave or TCP server interface.

The definition of the area is defined via the INI files that are stored on the Micro SD card. These files PCOSA020.INI und MBSRV.INI can be found in the directory PCOS_OHP.

For further information see chapters 5.4 and 5.6.

5.4 Enable the Service Routines and Interfaces

The individual service routines and interfaces are enabled using the PCOSA020.INI file. This file can be found in the directory PCOS_OHP on the CF card.

In the delivered status of the CF card all entries are inactive. By removing the double forward slash // the corresponding entry is enabled.

Caution: Only enable the service routines and interfaces that you require for your project. According to the settings in the file, the driver files (DLLs) are loaded into memory of the ALU020 during booting. Each enabled driver occupies memory space, even when it isn't used.

When the communication protocols IEC 60870-5-101 or –104 have been configured using the PLC configurator, the file PCOSA020.INI will be automatically created with the corresponding entries and can be sent to the ALU020 together with the project.

```
#=================================================================
#
#       ALU020 PCOS Einstellungen
#       ALU020 PCOS settings
#
#=================================================================
```

[PCOS-SYSTEM] SharedMemoryAddr=1000 SharedMemorySize=600 TimeSyncDelay=0	#Memory area for Shared-Memory #Start address ProConOs %MB3.1000 #Number of bytes in total to %MB3.1599 #Gang reserve in hours (1…72), 0 = off

```
#=================================================================
#
#       MODBUS Server Einstellungen: Speicher, Schnittstellen
#       max. 4 Schnittstellen möglich
#
#       MMODBUS server settings: memory, interface
#       max. 4 interface are possible
#
#=================================================================
```

[MODBUS-SERVER]	#Memory area for Modbus
//SharedMemoryOffset=200 //SharedMemorySize=308	#Start address #Number of Bytes in total
//Interface1= SSERIAL //Interface2= STCP_IP	#Slave Serial #Modbus TCP-Server

```
#=================================================================
#
#       Service-Routinen für IEC 60870-5-101 oder IEC 60870-5-104
#
#       Service Routines for IEC 60870-5-101 or IEC 60870-5-104
#
```

#==	

[SERVICE]
//Service1= SVC104SA
//Service2= SVC101SA
	
	#Protocol IEC 60870-5-104 (TCP/IP)
	#Protocol IEC 60870-5-101 (serial)

Example:

By enabling Interface1 and Service2 the example project included on the CF card can be activated, e.g. create a data transfer according to IEC 60870-5-101 via COM1 and communication to a Modbus-Master via COM2 of the ALU020.

5.4.1 Definition of Shared Memory

The total shared memory area or parts thereof can be used for a Modbus connection.
The start address can begin at 0 (%MB3.000). Please note always commence the Start Address using an even address (0, 2, 4, 200, 1000 etc.)

The length can up to a maximum of 16384. The length should also be an even number.

In the example the user program (AWP) is stored in the shared memory area from %MB3.1000 to %MB3.1599.

The total shared memory area or part thereof can be used for a Modbus communiction.

Example:

Variable A BYTE %MB3.1200
Variable A1 BOOL %MX3.1200.0
.
.
Variable A8 BOOL
%MX3.1200.7

5.4.2 Modbus RS232

If the entry for Modbus is enabled by erasing the // in interface1, then in the example the memory area %MB3.1200 to %MB3.1507 can be written and read via the Modbus RS232 interface.

[MODBUS-SERVER]
SharedMemoryOffset=200
SharedMemorySize=308

Interface1= **SSERIAL**

You can also have the total shared memory area at your disposal for Modbus communication. In the example the following settings are possible:

[MODBUS-SERVER]

SharedMemoryOffset=0
SharedMemorySize=600

Interface1= **SSERIAL**

Via the file MBSRV.INI this area will be designated for individual coils and registers.

For additional information see chapter 5.6.

5.4.3 Modbus TCP-Server

If the entry for Modbus TCP Server is enabled by erasing the // in Interface2, then in the example the memory area %MB3.1200 to %MB3.1507 can be written and read via the Modbus TCP interface.

[MODBUS-SERVER]

SharedMemoryOffset=200
SharedMemorySize=308

Interface2= **STCP_IP**

You can also have the total Shared Memory area at your disposal for Modbus communication. In the example the following settings are possible:

[MODBUS-SERVER]

SharedMemoryOffset=0
SharedMemorySize=600

Interface2= **STCP_IP**

Via the file MBSRV.INI this area will be designated for individual coils and registers.

For additional information see chapter 5.6.

5.4.4 Service-Routines

If communications via IEC 60870-5-101 and/or IEC 60870-5-104 are to be used, the relevant service routines must be enabled. It is possible to start several routines concurrently.

The setting

Service1= SVC104SA (corresponding parameter files SVC_COM1.INI and SVC_RTU1.INI)

Service2= SVC101SA (corresponding parameter files SVC_COM2.INI and SVC_RTU2.INI)

Enables the concurrent transmission data via TCP/IP and a serial connection.

The setting

Service1= SVC101SA (corresponding parameter files SVC_COM1.INI and SVC_RTU1.INI)

Service2= SVC101SA (corresponding parameter files SVC_COM2.INI and SVC_RTU2.INI)

enables the concurrent transmission data via both serial interfaces on the ALU020 with IEC 60870-5-101 protocol.

Comment: In the delivery status of the SD card the file SVC_COM1.INI is set for IEC 60870-5-104 protocol. When, as described above, both service routines should operate with serial protocol, copy the contents of the file SVCCOM2.INI into SVCCOM1.INI and change the settings according to your requirements. Pay particular attention to the fact that the settings for the ports in both files should be different.

5.5 IEC 60870-5-101 or -104 Communication

5.5.1 General

For the individual transmission protocols on the ALU020 up to 8 service routines can be started. For each service routine parameter data (SVCCOM?.INI) and the definition of the PV processing (SVCRTU?.INI) are assigned.

The protocols IEC 60870-5-101 and IEC 60870-5-104 with slave functionality are available.

The parameter data SVCCOM?.INI and SVC_RTU?.INI can be found in the directory PCOS-OHP on the SD card.

Remark: The individual parameters included in the files on the SD card can have differing assignments to those represented here.

Change the entries according to your requirements and subsequently save the files as those on the Micro SD card.

Note: If an entry is proceeded by a // then the corresponding line will not be processed. This is the same as erasing the line and results in the line not being activated. Parameters that are not required can be erased or deactivated.
The default setting for erased or deactivated parameters is 0, FALSE or OFF.

The entry TRUE corresponds to ON, the entry FALSE corresponds to OFF. Both variants of this expression can be used.

Note: The following maximum values are permissible for transmitted objects.

IEC101
Maximum 512 objects in monitoring and command directions in the SVCRTUn.INI file.
Maximum 128 Byte in command direction und 256 Byte in monitoring direction for the I/O configuration

IEC104
Maximum 1024 objects for Service 1 and 2 and max. 512 objects for all further service routines in the SVCRTUn.INI file.
Maximum 128 Byte in command direction and 256 Byte in monitoring direction for the I/O configuration

5.5.2 Parameter File for Communication Configuration IEC 60870-5-104 (SVCCOMn)

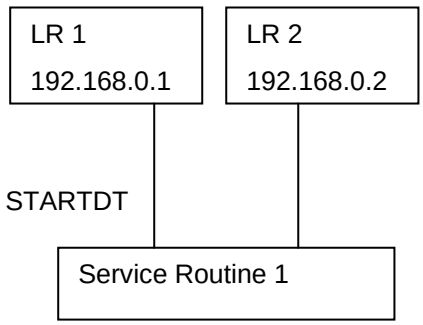
[IEC-5-104]	
PORT= 2404	Port number **Must not be changed!**
KVAL= 12	Max. difference between the number of receipt and send sequences
WVAL= 8	Latest acknowledgement after receipt from w APDU in I-format
T1= 15	Time monitoring for transmitted APDU or Test-APDU
T2= 10	Time monitoring for acknowledgements, where no data was transmitted
T3= 40	Time monitoring for transmitted test frames
IP_ADDR=192.168.0.1	IP address of the remote station

Using a service routine a maximum of two IEC 60870-5-104 connections can be created. However STARTDT can only be activated in **one** connection. In the second connection only the Testframes (TESTFR) will be confirmed.

You can enter the IP addresses of the communication partner (max. 2). Herewith is guaranteed that the ALU020 only allows a TCP/IP connection to these addresses. Connection attempts from other IP addresses will not be confirmed.

If no IP addresses are entered then a connection can be established with any IP address in the same subnet.

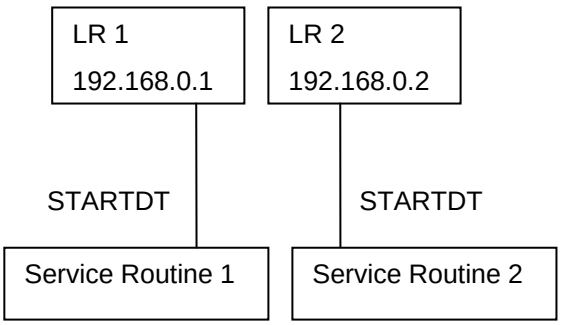
☞ **Note:** If a redundant data transmission is required using two connections with activated STARTDT, then two service routines must be programmed.



Data will only be exchanged with LR1

On LR2 only TESTFR will be answered

A change can only be induced with STOPDT on LR1 and subsequently STARTDT on LR2.



Data will be exchanged with both LRs

5.5.3 Parameter File for the Communication Configuration IEC 60870-5-101 (SVCCOM?.ini)

Open the file SVCCOM?.INI which you have stored on your computer using the editor.

You will now see the following entries:

[IEC-5-101]		
AWD= FALSE	TRUE = ADS operation, FALSE = Leased line operation	
PORT= 1	Port =1 or 2 corresponds to COM interface.	
BAUDRATE= 9600	Transmission rate to master station	
PARITY= EVEN	Parity NO / EVEN	(with leased line always EVEN)
DATA=8	Number of data bits	**Must not be changed!**
STOPBIT=1	Stop bit	**Must not be changed!**
TVS2=25	Lead time S2 [ms]	(only relevant with leased line)
TNS2=7	Follow-up time S2 [ms]	(only relevant with leased line)
TVM2=40	Lead time monitoring M2 [ms]	(only relevant with leased line)
TNM2=150	Follow-up monitoring M2 [ms]	(only relevant with leased line)
PAUSE=27	Pause time [ms]	
BUS_TOUT= 2	Bus monitoring (Slave) in n*[100ms]	
POLL_TOUT= 60	Monitoring poll cycle (Slave) in n*[100ms]	
S2SIGNAL= OFF	S2-Signal (RTS) switch on or off	
M2SIGNAL= OFF	M5/M2 monitoring (DCD/CTS) switch on or off	
CONF_SC= OFF	ON= Receipt confirmation with single character E5, OFF = Short telegram	
AVS= 3	Address of the connection layer	
OKTETT_AVS= 2	Octet number of the AVS (0 to 2)	
[AWD101-MODE]	!! AT instruction ASCII, max. 8 characters!!	
AT_INIT= ATZ0	Load stored profile into modem	
AT_HANGUP= ATH	AT instruction for hanging-up	
AT_DIAL= ATD	AT instruction for dialling	
AT_PICK_UP= ATA	AT instruction for picking-up	
# Modem RESPONSE/Response decimal		

//RSP_OK= 0
//RSP_CONNECT= 1
//RSP_RING= 2
//RSP_NOCARRIER= 3
//RSP_ERROR= 4
//RSP_NODIAL= 5
//RSP_BUSY= 6
//RSP_NOANSWER=7
	Here the customary values for modem response are given. If the modem you are using deviates from these values, then delete the double-slash „//“ before the entry and replace with your required value.	

RSP_TOUT= 2	Maximum waiting time for an AT instruction acknowledgement (1 to 15 Sec.)	

# Dial parameters / Connection structure	
DIAL_NUMBER= ?????????	Telephone number of the control station
DIAL_RETRY= 3	Re-dialling (1 to 7)
DIAL_TM_REDIAL= 30	Time [sec]: Pause when re-dialling (1 to 255)
DIAL_TM_RIDLE= 1	Time [min]: off-time after re-dialling (1 to 255)
DIAL_TM_CON= 60	Time [sec]: waiting time for connection "Connect" (1 to 255)
DIAL_TM_PW= 2	Time [sec]: waiting time until password is sent after establishing connection
DIAL_PRI_PW= ???????	Password primary station (master station) maximum 16 characters
DIAL_SEK_PW= ???????	Password secondary station (substation) maximum 16 characters

Comment: The individual parameters can differ from those in this representation.

5.5.3.1 Explanation of the Individual Parameters in Leased Line Operation

PORT

Here you declare the COM interface (1 or 2), which you want to use to connect to the IEC 60870-5-101.

BAUDRATE

The baudrate can be set to values between 600 and 9600 Baud.

PARITY, DATA, STOPBIT

When using leased-line or direct serial communication the parity should be set to EVEN. The number of data bits must always be 8 and the number of stop bits 1.

TVS2, TNS2, TVM2, TNM2, PAUSE, S2SIGNAL, M2SIGNAL

Via these parameters you can set the lead-time and follow-up time for S2 and the monitoring time for the M2 signal as well as the pause time between the telegrams. Above all these settings are necessary when using leased-line modems (UEM 202 or 201). Using the parameter S2SIGNAL, M2SIGNAL, the setting respectively the monitoring of the corresponding signals can be switched-off.

POLL_TOUT

Within this monitoring time the station must be polled, otherwise the connection will be reported as being faulty and can only be reactivated using “reset the remote link”.

BUS_TOUT

The monitoring **BUS_TOUT** declares the monitoring time when running line operation, within which time the local station or another station must be polled. If the station runs into the timeout, it waits for an initialisation of the connection layer.

With point-to-point or ADS operation the **BUS_TOUT** should not be set to a smaller value than the **POLL_TOUT**.

CONF_SC

Via this parameter you declare how the substation should respond when no data telegram is ready for transmission. ON= receipt acknowledgement with end-character E5, OFF= short telegram (telegram of fixed length).

AVS, OKTETT_AVS

AVS is the address of the connection layer and the stations are polled using this. The address can be 1 or 2 octets (byte) long. The setting must be designated for each station in the system via a compatibility list.

5.5.3.2 Explanation of the Individual Parameters in ADS Operation

PARITY, DATA, STOPBIT

With most dial-up modems or ISDN TAs the transmission is with 8 data bits without the possibility of parity. Hence, set PARITY= NO. This setting must also be configured on the device at the other end.

RSP_TOUT is the monitoring time during which the modem response (CONNECT, OK etc.) should be received. The default setting is suitable for most modem types and therefore must not be changed.

If an initiated connection to a substation is not achieved within the time given in the parameter **DIAL_TM_CON** then the dialling attempt will be aborted. After the waiting time **DIAL_TM_REDIAL** has elapsed, a new attempt will be initiated. This will be repeated until a connection is achieved or until the number of retries entered in the parameter **DIAL_RETRY** is reached.

If a connection is not achieved after the set number of dial-up attempts a timer is initiated. The time setting is entered in the parameter **DIAL_TM_RIDLE**. After this time has elapsed the procedure described above will be repeated anew.

The password for the central station (**DIAL_PRI_PW)** and the substation (**DIAL_SEK_PW**) can be a maximum of 16 characters long. If fewer characters are given, it will automatically be filled with blanks. Upper and lower case characters are checked. The given passwords must also correspond with those configured in the central station.

After a successful connection is achieved (connect from the modem), the central station or the substation will send its password. The password will always be sent from the side that initiated the connection and checked by the receiving station for authenticity. If the check is successful, polling will be commenced. If unsuccessful, the connection will be terminated with ATH.

5.5.4 Parameter File for Processing the Data Point Definition (SVCRTU?.ini)

[RTU_I10X] ASDU= 3 OKT_ASDU= 2 OKT_HERK=TRUE OKT_AINF= 3	 ASDU = Station address Number of octets in the address byte Reason for transmission with origin address Number of octets in the information object number
APDU_LEN=253 BLOCK_OBJEKT= TRUE BLOCK_ELEMENT= TRUE	Maximum length of the block telegram Blocking of the information objects permissible TRUE / FALSE Blocking of the information elements permissible TRUE / FALSE
IEC_CCI_TYP= O	Counter value enquiry | enquiry | operational mode [C | D | O]
RTU_COM_STOP=TRUE	Behaviour during a stop of the user program, TRUE= communication stopped, FALSE= continues running
EXEC_CMDNENABLE = TRUE EXEC_CMDNTIME = 10 EXEC_STIME= 3 EXEC_LTIME= 50	Instructions with quality identifier QU=0 are allowed Instruction execution time for instructions without additional definitions (QU=0) Shot instruction execution time (n * 100 ms) Long instruction execution time (n * 100 ms)
1:AP_NMB= 3600 1:AP_WARN= 2500	Number of telegrams in the archive for PVs with time tag (0 to 3600) Overflow warning of the archive buffer (by ADS operation leads to communication establishment).
OOFS_SP=100 OOFS_SP_TM=100 OOFS_DP=200 OOFS_DP_TM=200 OOFS_BO=300 OOFS_BO_TM=300 OOFS_ME=400 OOFS_ME_TM=400 OOFS_IT=500 OOFS_IT_TM=500	Object numbers - Offset single message (Single Point) Object numbers - Offset single message (Single Point) with time tag Object numbers - Offset double messages (Double Point) Object numbers - Offset double messages (Double Point) with time tag. Object numbers - Offset bit string Object numbers - Offset bit string with time tag Object numbers - Offset measured value Object numbers - Offset measured value with time tag Object numbers - Offset counter value Object numbers - Offset counter value with time tag
OOFS_SC= 600 OOFS_DC=700 OOFS_SE=800 OOFS_CBO=900	Object numbers – Offset single instruction (Single Command) Object numbers - Offset double instruction (Double Command) Object numbers - Offset set value standardised (Set-point command) Object numbers - Offset bit string (bit string of 32 Bit))

# Internal instructions for the variables (data processing) # Data variant Var1	
1:VAR_XX_ABF= TRUE 1:VAR_XX_SPO= TRUE 1:VAR_XX_AWD= FALSE 1:VAR_XX_AP= 1 1:VAR_XX_GRP=1	Interrogation active, general interrogation or counter interrogation Enables spontaneous transmission 1= by ADS operation commences establishment of communication Cyclic in the archive buffer 0 = no, archive 1…3 Value will be transmitted via GI with group enquiry 1
# Internal instructions for the variant 1only for double messages (DP)	
1:VAR_DP_TS=100	Faulty state information suppression time, 0 = no monitoring, n * 10 ms
# Internal instructions for the variant 1only for bit string (BO)	
1:VAR_BO_NMB=32	Number of process points, 1…32 per bit string
# Internal instructions for the variant 1only for integral totals (IT)	
1:VAR_IT_IMPS= 0	Impulse threshold 0 to 65535 (def. = 0, off)
# Internal instruction for variant 1 only for integral totals (IT) and measured values (ME)	
1:VAR_ITME_ZYK = 5	Difference and cycle time= n* minute, 0 to 3600, 0 = off
# Internal instruction for the variant 1 only for measured values (ME)	
1:VAR_ME_AZI=512	Deviance time integral, AZI = 0… 32760 / 0x7FF8 12 bit measured value + sign, left aligned (AZI = 8 corresponds to the change of one digit on the input)
1:VAR_ME_OV=32000	Over range (OV) from 0 to 32767 (0x7FFF)
# Internal instruction for the variants (data processing) # Data variant Var2	
2:VAR_XX_ABF= TRUE 2:VAR_XX_SPO= TRUE 2:VAR_XX_AP= 0 2:VAR_XX_GRP=2	Enquiry active, general enquiry or counter enquiry Spontaneous Cyclic in the archive buffer 0 = no, archive 1…3 Value will be transmitted via GI with group enquiry 2
# Internal instruction for the variant 2 only for integral totals (IT)	
2:VAR_IT_IMPS= 20	Impulse threshold 0 to 65535 (def. = 0, off)
# Internal instruction for variant 2 only for integral totals (IT) and measured values (ME)	
2:VAR_ITME_ZYK = 0	Difference and cycle time= n* minute, 0 to 3600, 0 = off
# Internal instruction for the variant 2 only for measured values (ME)	
2:VAR_ME_AZI=256	Deviation time integral, AZI = 0… 32760 / 0x7FF8 12 bit measured value + sign, left aligned (AZI = 8 corresponds to the change of one digit on the input)
2:VAR_ME_OV=32000	Over range (OV) from 0 to 32767 (0x7FFF)
# Internal instruction for the variants (data processing)	

# Data variant Var3	
3:VAR_XX_ABF= TRUE 3:VAR_XX_SPO= FALSE 3:VAR_XX_AP= 1	Enquiry active, general enquiry or counter enquiry No spontaneous transmission Cyclic in the archive buffer 0 = no, archive 1…3
# Internal instruction for variant 3 only for integral totals (IT) and measured values (ME)	
3:VAR_ITME_ZYK = 5	Difference and cycle time= n* minute, 0 to 3600, 0 = off
# Internal instruction for the variant 3 only for measured values (ME)	
3:VAR_ME_AZI=0	Deviance time integral, AZI = 0… 32760 / 0x7FF8 12 bit measured value + sign, left aligned (AZI = 8 corresponds to the change of one digit on the input)
	Up to 16 different processing variants can be defined
# Logical operation assignment of process data in the monitoring direction	
QX0.0:TAG_SP_TM= 1;V1 QX0.0:TAG_SP= 1;V1 QX0.1:TAG_SP= 2;V1 QX0.4:TAG_DP=1;V1 QD4:TAG_BO=1;V2 QW8:TAG_ME= 1;V1; QW10:TAG_ME= 2;V2; QW12:TAG_ME_TM= 3;V1; QW14:TAG_ME_TM= 4;V2; QD16:TAG_IT= 1;V1 QD20:TAG_IT_TM= 2;V1 QD24:TAG_IT= 3;V2 QD28:TAG_IT_TM= 4;V2	Single event with time tag Single event without time tag Double event Bit string 32 Bit Measured value without time tag defined as WORD Measured value with time tag defined as WORD 32 bit integrated value defined as DWORD

# Logical operation assignment of process data in the control direction	
IX0.0:TAG_SC= 1;V1 IX0.1:TAG_SC= 2;V1	In the 1st transmission byte array two single commands are entered
IW2:TAG_SE=1;V1	In the 2nd and 3rd bytes of the transmission array a set value are entered
IW4:TAG_SE=2;V1	In the 5th and 6th bytes of the transmission array a set value are entered

Explanation of the individual parameters

ASDU, OKT_ASDU:

The **A**pplication **S**ervice **D**ata **U**nit is the station address. The length is only variable with IEC 60870-5-101, when using IEC 60870-5-104 it is preset to the value 2.

OKT_HERK:

Declares whether the transmission reason will be transmitted with or without the source address. In IEC 60870-5-104 the octet for the source address is always included, for the ALU 320 it is fixed to ZERO.

OKT_AINF:

Address length for the information object. It can be 1, 2 or 3 bytes long. The length is only variable with IEC 60870-5-101, with IEC 60870-5-104 it's fixed with 3 bytes.

APDU_LEN= 30

The maximum length of the APDU (Application Protocol Data Unit = telegram) can be set. With IEC-870-5-104 the maximum length is 253 bytes (255 less the start and length octet)

BLOCK_OBJEKT

This switch determines whether the transmission of a number of PVs as blocked information objects is permissible.

The default setting= TRUE, because it enables an optimised transmission of the PVs to be achieved especially with GAs. The switch should only= FALSE when the superior system can process this type of block telegram

BLOCK_ELEMENT

This switch determines whether the transmission of a number of PVs as blocked information elements is permissible.

The default setting= TRUE, because it enables an optimised transmission of the PVs to be achieved especially with GAs. The switch should only= FALSE when the superior system can process this type of block telegram.

IEC_CCI_TYP= O

This standard enables the transmission of integral totals in one of 4 modes - the operational modes A, B, C and D. Mode A can be realised by using the parameter VAR_ITME_ZYK in the definition of the processing variants.

With modes B, C and D a counter enquiry instruction (CI counter interrogation) will be sent from the superior system. The ALU 320 supports only operational modes C and D as well as an OHP specific procedure (O) in which the integral totals are immediately transmitted after a restore instruction (counter interrogation command with FRZ= 1, RQT= 1…5) where the cause of transmission was 37 … 41. This is a variation on the operational mode C (where a counter enquiry instruction FRZ=0, RQT=1…5 is not sent).

RTU_COM_STOP

This switch determines whether the communication to the master station should be discontinued or not when the user program is stopped.

FALSE= the communication driver continues to operate and poll telegrams are answered with a short telegram or E5. When the user program is stopped all defined PVs are transmitted with invalid bit set. If the user program is restarted, the invalid bits will be reset and the PVs transmitted.

RTU_TIME_SET

0 = Time may be set via IEC (default)
1 = Time may never be set via IEC
2 = Time may only be set via IEC, when the current time IV is invalid

RTU_TIME_ACK_NEG

FALSE = IEC time telegram is confirmed with a positive response (default)
TRUE IEC time telegram is confirmed with a negative response

This parameter is only valid when RTU_TIME_SET is not equal to NULL!

RTU_TIME_SYNC_ENABLE

Entry in minutes (1…65535)
Delta time designation in minutes, since the last setting of the clock. After it has elapsed the clock can be set using an IEC telegram.
This parameter is only valid when RTU_TIME_SET = 2!

EXEC_CMDNENABLE, EXEC_CMDNTIME:

When the parameter EXEC_CMDNENABLE = TRUE, then instructions with the quality identifier QU= 0 (without additional definition) will be received and then transmitted after the time set in the parameter EXEC_CMDNTIME. If the parameter EXEC_CMDNENABLE = FALSE, then the instructions with QU=0 will be negatively confirmed and not executed.

This setting is normally used when the instruction execution times in the station are individually chosen for each instruction. If the user program is realised in this way, then it should be noted, that the ALU 320 "Termination of Activation" (cause of transmission 10) is always transmitted after the time set in EXEC_CMDNTIME has elapsed.

EXEC_STIME, EXEC_LTIME:

Here the short and long instruction output times are defined. At what time the instructions are outputted, is defined via the instruction identifier in the telegram from the central station. Time base: n * 100 ms.

?:AP_NMB, ?:AP_WARN:

The number of telegrams that the archive buffer should hold is defined in (AP_NMB).

The parameter 1:AP_WARN is only active in ADS operation. It declares at what buffer level the substation automatically initiates a connection to the superior system.

A maximum of 3000 telegrams can be stored. The number can be divided in up to 3 archives.

OOFS_??:

Via this parameter you can enter an offset for each data type, it will be added to the object numbers declared during input definition. Use of the offsets enables **all** object numbers of a specific data type to be shifted to another area.

In the example above the first 2 bits in first transmission byte are transmitted as single messages with the object numbers 101 and 102 because the parameter OOFS_SP has a value of 100.

Bits 4 and 5 are transmitted as a double message with the object number 201.

Bytes 4…7 of the transmission block (defined as DWORD) are transmitted as a bit string with the object number 301.

The 4 measured values (defined as WORD), which are transmitted, commencing byte 8, will each be transmitted with and without a time tag in the object numbers 401, 402, 403 and 404.

The 4 integral totals (defined as DWORD), for transmission commencing byte 16, are transmitted with the object numbers 501, 502, 503 and 504.

Note: It is recommended that the offsets for PVs with or without time tags should be set identically and to number the inputs consecutively. In this way an optimal data transmission is achieved during a general enquiry.

Processing variants:

Up to 8 different processing variants (1:VAR…, 2:VAR… etc.) can be defined. These are subsequently assigned to the individual inputs. There are parameters that are valid for all data types (identified with XX), others relate to specific data types (e.g. VAR_IT_IMPS valid only for integral totals).

?:VAR_XX_ABF

TRUE = Process variable will be transmitted during a general enquiry (global).

?: VAR_XX_GRP=1

Via this parameter a general enquiry can be undertaken as a group enquiry (group 1 … 16).

?:VAR_XX_SPO

TRUE= Process variable is spontaneously transmitted on a change of state.

?:VAR_XX_AWD

TRUE= Initiation of a connection to the central station on a change of the process variables.

?:VAR_XX_AP

Write process variables periodically into the archive. 1= yes, 0= no.

?:VAR_BO_NMB

Via this parameter you can declare the number of consecutive bits in a transmission array that will be consolidated into a bit string. Area: 1…32.

?:VAR_IT_IMPS

Impulse threshold in the range 0 to 65535. On reaching the configured threshold the integral value is spontaneously transmitted (cause of transmission 3). Setting 0 means, that the integral value will only be transmitted by integral value interrogation or, if configured, periodically.

?:VAR_ITME_ZYK

Defines the time interval for the periodic transmission of integral and measured values. The values will be transmitted according to the settings in the parameters OFFS_IT / OFF_ME or OOFS_IT_TM / OOFS_ME_TM, with or without time tag and the cause of transmission 3 (spontaneous).

Entries in minutes in the range between 1 to 3600. Entry 0= no periodic transmission.

?:VAR_ME_AZI

Setting the deviation time integral. The measured value changes are recorded and added together according to their sign at 1 second intervals, commencing at the moment of the last transmission. If the sum of these additions reaches the AZI setting the measured value will be transmitted with the cause of transmission 3 (spontaneous). Using this method the measured value transmission will be dampened down. Slowly rising measured values will be transmitted with a time lag and on the other hand fast rising measured values transmitted more quickly.

If the setting AZI=0 and the parameter VAR_XX_SPO=TRUE, then every measured value change will be transmitted. Consider here that the measured value inputs generally fluctuate.

?: VAR_ME_OV

Here you can declare the limit of the over range. If the measured value exceeds the preset value, then the over range bit will be set in the quality identifier. Setting 0 means no monitoring.

Measured values are taken over 1:1 from the transmission array and entered in the telegram. It is the responsibility of the user program to ensure that the measured values are presented in the standardised format.

Definition der Übergabeblöcke:

Syntax: reference transfer field: IEC type= object number; processing variant

The reference on the transfer field can be entered as a QX?.? (BIT), QB (BYTE), QW (WORD) or QD (DWORD). In the command direction IB?.?, IB, IW and ID are used.

The reference is **relative** and always correlates to the transfer field defined for the service routine. If, in the I/O configuration of MULTIPROG, the output for this service is for example defined as %QB501 to %QB628, then during declaration of the transfer field, QB0 will define the contents of %QB501, QB1 of %QB502, etc.

Maximum length of the transfer blocks:

Command direction	256 Byte
Reporting direction:	512 Byte

Messages are defined using QX?.?. With double messages, the first of the two consecutive bits is given as reference.

Measured values (16 bit) are defined using QW.

Bit strings and counter values (32 Bit) are defined using QD.

Commands are defined using IX?.? Whereby with double commands, the first of the two consecutive bits is given as reference.

Set values (16 bit) are defined using IW.

Bit strings (32 bit) are defined using ID.

Example:

QX0.0:TAG_SP_TE= 1;V1

QX0.0:TAG_SP= 1;V1

The 1st bit in the transfer block will be transmitted as a **S**ingle **P**oint either with or without a time tag. For transmission parameters defined in the variant 1 apply.

QD16:TAG_IT= 1;V1

Bytes 16 to 19 of the transferred integral value are transmitted with parameters defined in the variant 2. In the example the transmission is always after 5 minutes and on counter interrogation.

QD28:TAG_IT= 4;V2

Bytes 28 to 31 of the transferred integral value are transmitted with parameters defined in the variant 2. In the example the transmission is always after 5 counter pulses with time tag and on counter interrogation.

TAGs of the IEC Type:

TAG_SP	**S**ingle **p**oint information
TAG_SP_TM	**S**ingle **p**oint information with **tim**e tag
TAG_DP	**D**ouble **p**oint information
TAG_DP_TM	**D**ouble **p**oint information with **tim**e tag
TAG_IT	**I**ntegrated **t**otal
TAG_IT_TM	**I**ntegrated **t**otal **tim**e tag
TAG_ME	**Me**asured value normalized
TAG_ME_TM	**Me**asured value normalized with **tim**e tag
TAG_BO	**B**it string **o**f 32 Bit
TAG_BO_TM	**B**it string **o**f 32 Bit with **tim**e tag
TAG_SC	**S**ingle **c**ommand
TAG_DC	**D**ouble **c**ommand
TAG_SE	**Se**t-point command normalized value
TAG_CBO	**B**it string **o**f 32 Bit command direction)

5.6 Configuration of the Initialisation File for Modbus RS232 Slave or TCP-Server

The file MODBUS_SERVER.INI is stored in the directory PCOS_OHP and is used both for Modbus RS232-Slave and also for Modbus TCP-Server.

#===================================== # MODBUS SERVER / SLAVE Konfigurationsdatei # MODBUS SERVER / SLAVE configuration file #===================================== #---------- # Interface 1 - SERIAL - Seriell #---------- # Communication parameter: Modbus slave serial Interface - Service 1	
[IF1-COM-MODBUS-SSERIAL] PORT= 2 BAUDRATE= 9600 PARITY= EVEN DATA=8 STOPBIT=1 PAUSE=10 BUS_TOUT= 2000 ASCII= FALSE SLAVE_ADR= 1	# PORT [xx], 0 ... off # Stop bit (1= default) # minimum waiting time [ms] between requests and responses # Bus monitoring (Slave) in n*[ms], def. (2000), range1000 to 2000 # Protocol ASCII, FALSE/TRUE; (def. FALSE -> RTU)
# Serverparamter für Modbus Slave Serial interface - Service 1	
[IF1-SERV-MODBUS] REF_BASEINDEX= 0 STATUS_OFFSET= 300 STATUS_LEN= 6	# 0/1 default (0) # 2, 4 or 6 bytes long
# 0x COILS - Read/Write - 1 bit access REF0_OFFSET= 0 REF0_LEN=50	 # REF0: Offset in byte, Modbus server # Length in byte (50 x 8 COILS)
# 1x Discret Input - Read - 1 bit access REF1_OFFSET= 50 REF1_LEN=50	 # REF1: Offset in Byte, Modbus server # Length in Byte (50 x 8 discrete inputs)
# 3x Input Register - Read - 16 bit access REF3_OFFSET= 100 REF3_LEN=100	 # REF3: Offset in Byte, Modbus server # Length in Byte (100 corresponds to 50 input registers)
# 4x Holding Register - Read/Write - 16 bit access REF4_OFFSET= 20 REF4_LEN=100	 # REF4: Offset in Byte, Modbus server # Length in Byte (100 e corresponds to 50 holding registers)
#---------- # Interface 2 - Modbus TCP/IP Server (MODBUS-STCP_IP) #---------- # Communication parameter: Modbus - STCP_IP interface 2	

[IF2-COM-MODBUS-STCP_IP]
//IP_ADDR= 192.168.0.101
//IP_ADDR= 192.168.0.102
//IP_ADDR= 192.168.0.103
	
	#IP address of the participant
	#IP address of the participant
	#IP address of the participant

//IP_ADDR= 192.168.0.104	#IP address of the participant
# Server parameter for Modbus TCP interface 2	
[IF2-SERV-MODBUS] REF_BASEINDEX= 0 STATUS_OFFSET= 300 STATUS_LEN= 6	# 0/1 default (0) # 2, 4 or 6 bytes long
# 0x COILS - Read/Write - 1 bit access REF0_OFFSET= 0 REF0_LEN=50	 # REF0: Offset in Byte, Modbus server # Length in byte (50 x 8 coils)
# 1x Discret Input - Read - 1 bit access REF1_OFFSET= 50 REF1_LEN=50	 # REF1: Offset in Byte, Modbus server # Length in byte (50 x 8 discrete inputs)
# 3x Input Register - Read - 16 bit access REF3_OFFSET= 100 REF3_LEN=100	 # REF3: Offset in Byte, Modbus server # Length in byte (100 corresponds to 50 input registers)
# 4x Holding Register - Read/Write - 16 bit access REF4_OFFSET= 20 REF4_LEN=100	 # REF4: Offset in Byte, Modbus server # Length in byte (100 corresponds to 50 holding registers)

5.6.1 Explanation of the Individual Parameters

With [IF1…], [IF2…], [IF3…] etc. is specified in which interface the ensuing parameters refer to.

[IF1-COM-MODBUS-SSERIAL]

[IF-1-COM-MODBUS-SSERIAL] declares, that this setting is valid for interface 1 with a serial Modbus communication.

PORT

Here you declare COM interface (1 or 2), which you want to use for Modbus RS232 slave communication.

BAUDRATE

The baudrate can be set between 600 and 9600 baud.

PARITY, DATA, STOPBIT

Parity can be selected between EVEN or ODD. The number of data bits must always be 8 and the stop bits 1.

PAUSE

The pause time in ms between polling and receiving an answer. Via this parameter the reply telegram can be delayed, when the master is not able to immediately receive an answer.

BUS_TOUT

Bus monitoring in ms. Range 1000 to 2000, default setting 2000 (2 seconds).

The slave checks, whether during the set monitoring time, bus telegrams have been transmitted. If this is not the case, the status “communication fault” is set.

ASCII

Switch for Modbus-ASCII or Modbus-RTU. At this time **only** Modbus-RTU is possible, setting ASCII=FALSE.

SLAVE_ADR
Here you set the slave respectively the node address.

[IF1-SERV-MODBUS]

The following instructions and parameters apply for the interface 1 and define the range over which Modbus can be read and written.

REF_BASEINDEX= 0

Here you declare, whether the Modbus master addresses the 1st coil respectively register. The default setting is 0.

STATUS_OFFSET, STATUS_LEN

Using both of these parameters you define, from which MB3.???? address the Modbus status will be stored and how many bytes should be displayed for the status. The length can be set to 2, 4 or 6 bytes.

The shared memory area reserved for Modbus communication can be divided into bit and word areas. For this, both an offset and a length can be given. These areas can then be read and written to using the corresponding function codes.

In a similar way to other Modbus configurations these areas are defined as follows:

0 reference = Output or marker bits
1 references = Input bits
3 references = Input words
4 references = Output or marker words

REF0_OFFSET, REF0_LEN

This area can be processed using the following function codes:

FC 1 Read coils
FC 5 Write single coil
FC 15 Write multiple coils

REF1_OFFSET, REF1_LEN

This area can be processed using the following function codes:

FC 2 Read inputs Read Discrete Inputs

REF3_OFFSET, REF3_LEN

This area can be processed using the following function codes:

FC 4 Read input register.

REF4_OFFSET, REF4_LEN

This area can be processed using the following function codes:

FC 3 Read holding register
FC 6 Write single register
FC 16 Write multiple registers
FC 23 Read/write multiple register

This area can also be configured overlapping:

With the setting

REF0_OFFSET= 0
REF0_LEN=50

REF4_OFFSET= 0
REF4_LEN=50

The first 50 bytes of the shared memory can be read respectively written with the function codes FC1, FC5 and FC15 as well as with the function codes FC3, FC6, FC16 and FC23.

[IF2- COM-MODBUS-STCP_IP]

[IF-2-COM-MODBUS-STCP_IP] declares that this setting is valid for interface 2 with Modbus TCP server communication.

IP_ADDR= ?????

In cases where the TCP connection should only be enabled for certain clients, their IP addresses can be entered here. Four connections can be simultaneously established. If no IP addresses are declared, then the first four clients have access.

[IF2-SERV-MODBUS]

The following instructions and parameters apply for the interface 2 and define the range over which Modbus can be read and written.

For a description of the base index, status and references see above.

Using the example configuration the same memory area can be read and written to via a serial Modbus connection and also a TCP/IP connection, when both interfaces are enabled in PCOSA020.INI.

Both connections can however be assigned with separate areas. This should be considered correspondingly in the shared memory and in the definition of the references.

6 Firmware Library

6.1 General

The library ALUX2X_OHP_??? has been developed for Multiprog version 4.6. The firmware library will be revised after the changeover to Multiprog version 4.8 and the integration of the function “Send Changes”. The new library has the name ALUX2X_OHP4_???.

When installing OHP Add-Ons both versions will be installed thereby maintaining the compatibility for your older projects. This however only applies to the products @120 and @250.

When your project contains no OHP library, you can integrate it as follows:

Click the *Libraries* entry in the *Project Tree* menu with the right-hand mouse button. Afterwards using *Insert – Firmware Library* the new library can be incorporated.

☞ **Path for the FW library:** [Lw]:\Programme\OHP\Multiprog_48\Multiprog\PLC\FW_LIB\

OHP has provided the following libraries:

For PROCONOS 3

ALUX20_OHP_SCOM

ALUX20_OHP_SEAB

ALUX20_OHP_SYS

For PROCONOS 4 (online change)

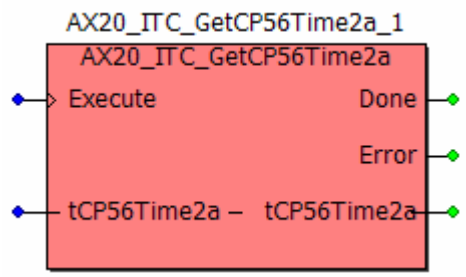
ALUX20_OHP4_SCOM	(Functions for free communication via the RS232 interface, see special description)
ALUX20_OHP4_SEAB	(Functions for communication via IKOS, see special description)
ALUX20_OHP4_SYS	(Diverse general functions)
ALUX20_OHP4_SYS_SA	(Functions for fault analysis and for DEA coupling evaluation)

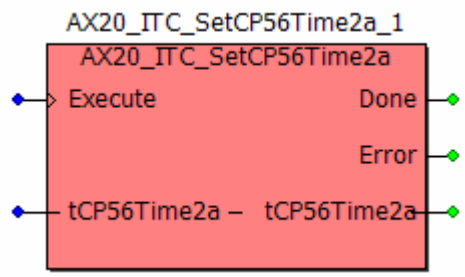
☞ **Note:** When using the Micro only functions in the ALUX20_OHP4_SYS library can be used.

6.2 Library ALUX20_OHP4_SYS

6.2.1 Reading and Setting the ALU020 System Time in the User Program

Function blocks AX20_ITC_GetCP56Time2a and AX20_ITC_SetCP56Time2a





Input variable (VAR_IN):

Execute	: BOOL	Enable flag for the function block, 1 = execute

Output variable (VAR_OUT):

Done	: BOOL	1 = Function executed
Error	: BOOL	1 = Function faulty

Input/output variable (VAR_IN_OUT):

tCP56Time2a	: 7 Byte	System time (date/time)

The system time is displayed according to IEC 60870-5-4, CP56Time2a in 7 bytes as follows:

2^7	Milliseconds						2^0
2^{15}	0…59999						2^8
IV	Res	2^5	Minute 0…59				2^0
S	Res		2^4	Hours 0…23			2^0
2^7	WT 1..7	2^5	2^4	Day of the month 1…31			2^0
Res			2^3	Month 1…12			2^0
Res	2^6	Year 0…99					2^0

IV = invalid
IV <0> = valid
IV <1> = invalid

S = summer time
S<0> = normal time
S<1> = summer time

WT = day of the week
WT<0> = no entry
WT<1> = Monday
:
WT<7> = Sunday

In Multiprog the time can depicted for example be in an array or in a structure.

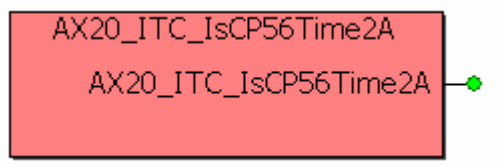
```
TYPE
   ArrayTime      :        ARRAY [1..7] OF BYTE;
END_TYPE


TYPE
IEC_Time:
   STRUCT
         ms:              WORD;
         minute:          BYTE;
         hour:            BYTE;
         day:             BYTE;
         mon:             BYTE;
         year:            BYTE;
   END_STRUCT;
END_TYPE
```

A variable of the type IEC_Time or ArrayTime is transferred to the function block AX20_ITC_GetCP56Time2a to retrieve the current time or to set the time using the function block AX20_ITC_SetCP56Time2a -

The OHP project submittals already include the IEC_Time structure in the data type declaration.

6.2.2 Status of the ALU020 Read System Time

Function AX20_ITC_IsCP56Time2A



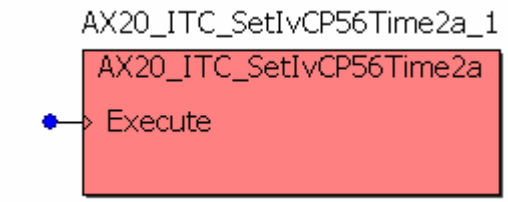
Beware: Don't use any EN/ENO for the OHP functions.

Output variable (VAR_OUT):

AX20_ITC_IsCP56Time2A	: BOOL	Status of the system time 0 = Time is invalid 1 = Time is valid

6.2.3 Status of the ALU020 Set the System Time to Invalid

Function block AX20_ITC_SetIvCP56Time2A

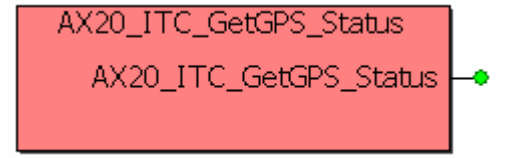


Input variable (VAR_IN):
Execute : BOOL Enable flag for the function block, 1 = execute

If this function block is executed, the ALU system time will be set to invalid. This call can be used for example in a system task cold and/or warm start, to set the system time to invalid after a restart, until it is specifically set again (GPS, SNTP).

6.2.4 Status of the ALU020 System Time with GPS Synchronisation

Function AX20_ITC_GetCP56GPS_Status



Beware: Don't use any EN/ENO for the OHP functions.

Output variable (VAR_OUT):
AX20_ITC_GetCP56GPS_Status : DWORD Status of the system time with GPS synchronisation

Status in Hex:

16#00000001 GPS module ready

16#00000003 Time set

16#81000001 Due to a GPS warning „time invalid" the time cannot be adopted

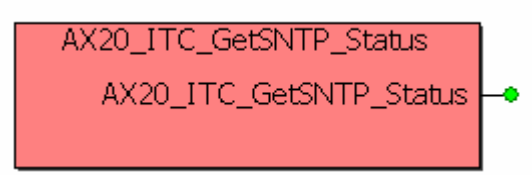
16#82000001 Error on setting the time

16#84000001 RMC data set error

16#88000001 No connection to the GPS module

6.2.5 Status of the ALU020 System Time with SNTP Synchronisation

Function AX20_ITC_GetCP56SNTP_Status



Beware: Don't use any EN/ENO for the OHP functions.

Output variable (VAR_OUT):
AX20_ITC_GetCP56SNTP_Status : DWORD Status of the system time with SNTP synchronisation

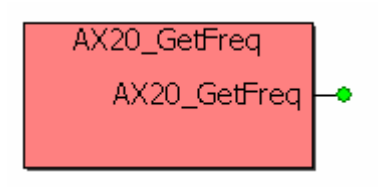
Status in Hex:

16#00000001 Connection to SNTP server enabled

16#00000003 Time set

6.2.6 System Clock

Function AX20_ITC_GetFreq



Beware: Don't use any EN/ENO for the OHP functions.

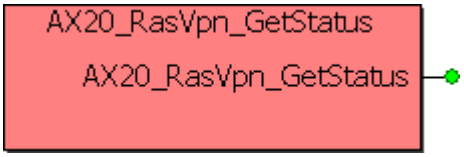
Output variable (VAR_OUT):
AX20_ITC_GetFreq : WORD Blink pulse

☞ **Note:** There is a special block ILAX20_GetFreqk for the instruction list (IL) programming language. The functionality is the same, however the block has an additional execute input.

Bit	Frequency	Time Grid
X0	20 **Hz**	50 ms
X1	10 **Hz**	100 ms
X2	5 **Hz**	200 ms
X3	2,5 **Hz**	400 ms
X4	1,25 **Hz**	800 ms
X5		Not defined
X6		Not defined
X7		Not defined
X8	2 **Hz**	500 ms
X9	1 **Hz**	1 s
X10	0,5 **Hz**	2 s
X11	0,25 **Hz**	4 s
X12	0,125 **Hz**	8s
X13		Not defined
X14		Not defined
X15		Not defined

6.2.7 Status of the GPRS Connection

Function AX20_RasVpn_GetStatus



Beware: Don't use any EN/ENO for the OHP functions.

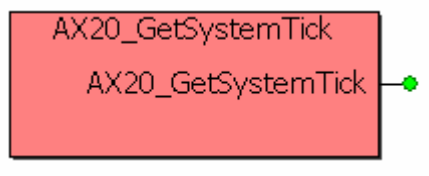
Output variable (VAR_OUT):
AX20_RasVpn_GetStatus : DWORD Status of the connection

This function delivers the status of the RAS and VPN connection during data transfer with the internal GPRS-modem.

Status in Hex	Meaning
16#00000001	Initialisation running
16#00000002	GPRS module ready
16#00000003	GPRS module ready – no connection
16#00000004	GPRS module ready - modem connection discontinued
16#00000005	GPRS module ready – VPN connection/login discontinued
16#00000006	GPRS module ready – VPN connection no login - PPP discontinued
16#00000008	Start modem connection
16#00000009	Modem connection ok
16#0000000A	Start VPN connection
16#0000000B	VPN tunnel exists
16#0000000C	Forced disconnection LOGOUT/LOGIN
16#0000000D	Forced disconnection after Traffic
16#0000000E	Hardware reset triggered
16#0000000F	Software reset triggered
16#00000010	Number of connection attempts to the provider reached
16#00000011	Number of connection attempts to VPN reached

6.2.8 System Tick

Function AX20_GetSystemTick



Beware: Don't use any EN/ENO for the OHP functions.

Output variable (VAR_OUT):
AX20_GetSystemTick : DWORD Time in milliseconds

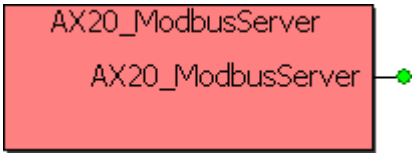
This function delivers the current time in milliseconds since the ALU was started.

Forwards counter with transient point. Therefore the value will be set to zero after 49.71 days (2^{32} milliseconds).

Note: There is a special block ILAX20_ GetSystemTick for the instruction list (IL) programming language. The functionality is the same however the block has an additional execute input.

6.2.9 Modbus Server

Function AX20_ModbusServer



Beware: Don't use any EN/ENO for the OHP functions.

Output variable (VAR_OUT):
AX20_ModbusServer : INT Status

Status = 0 = Modbus driver not working
Status = 1 = Modbus driver working

When the ALU uses either Modbus-RS232-Slave or Modbus-TCP-Server transmission protocol, this block should be called at least once in the default task. The block answers the interrogation from the master/client. Hence it is ensured that the contents of the individual registers originate from the same program cycle. This is especially important when values are to be calculated that have a specific relationship to one another.

If this block is not used, it can happen that the contents of a telegram originate from different program cycles because the Modbus driver processes the data asynchronously with respect to the program cycle.

Note: There is a special block ILAX20_ ModbusServer for the instruction list (IL) programming language. The functionality is the same however the block has an additional execute input.

7 Tips and Tricks

7.1 Set the Time and Diagnosis via Telnet

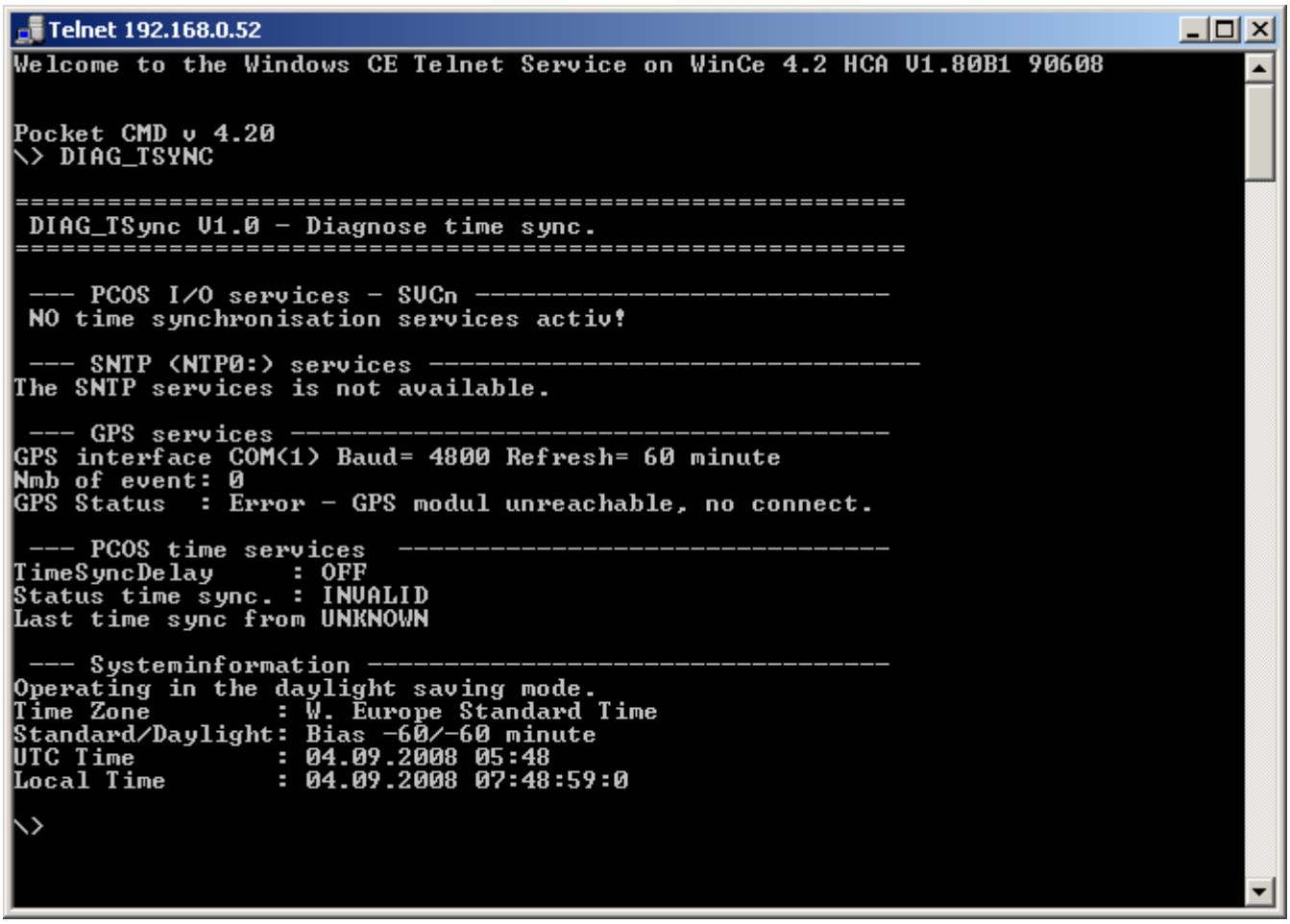
You can set the ALU system time or determine the status of the ALU system time using a Telnet connection.

- To do this, connect the PC to the Ethernet interface of the ALU020.
- Using the *Run* dialogue in the Windows start menu; enter *telnet 192.168.0.20* (if you have changed the ALU IP address, enter the modified address).

The dialogue window, which subsequently appears, will contain the WindowsCE version and the firmware version.

The following functions will now be available:

- Using *time* the current time will be displayed and can be changed.
- Using *date* the current date will be displayed and can be changed.
- *DIAG_TSYNC* displays the status of the ALU system time



PCOS I/O services –SVCn

If the system time is set using a service routine (IEC 60870-5-101 or 104 time synchronisation), it will be displayed in this category.

SNTP <NTP0:> services

If the system time is set using a time server, it will be displayed here. The function must be enabled in the ALU020.INI.

"SNTP service is not available" means that the service has not been enabled in the ALU020.INI.

GPS services

Displays the status of the synchronisation via the time receiver GPSRVC. This function must be enabled in the ALU020.INI. See chapter 5.1.3.

"GPS service is not available", means that the service has not been enabled in the ALU020.INI.

7.2 ALU Status Information via Telnet

Using a Telnet connection you can call diverse diagnostic functions.

- To do this, connect the PC to the Ethernet interface of the ALU or use an existing GPRS connection.
- In the *Run* dialogue of the Windows start menu enter *telnet 192.168.0.20* (if you have changed the ALU IP address, enter the modified address).

The dialogue window, which subsequently appears will contain the WindowsCE version and the firmware version.

☞ **Note:** The following entries are only examples and can differ from the actual entries depending on the ALU configuration.

Services List

Using this call you can determine which drivers and routines are running on the ALU.

Example:

```
TEL1:   0x00000000      TELNETD.Dll     Wird ausgeführt
S4U0:   0x00000000      \sd card\pcos_sys\SVC_SEK_I104SUS.dll      Wird ausgeführt
AUC1:   0x00000000      sd card\a020_sys\AX20UDPCFG.dll            Wird ausgeführt
SMB0:   0x00000000      smbserver.dll   Wird ausgeführt
MMQ1:   0x00000000      MSMQD.Dll       Aus
OBX0:   0x00000000      OBEXSrVr.dll    Aus
FTP0:   0x00000000      FTPD.Dll        Wird ausgeführt
TEL0:   0x00000000      TELNETD.Dll     Wird ausgeführt
HTP0:   0x00000000      HTTPD.DLL       Aus
```

diag_cpu

Displays the operating system, hardware and driver versions.

```
=========================================
OS Version          : 6.0 Build 0 Pb-Id 3
ALU Version         : 2.50 Build 0.1 14.01.10
PLC SYSTEM          : Micro
PLC ALU             : ALU 020
ProConOs Version    : 4.40
Pcos  Version       : 3.30
-----------------------------------------
MicroSDBoot BuildId:  24022010B01
FPGA HW REVISION    :  1.1
FPGA SW REVISION    :  1.15
DIP_SWITCH          :  0x48
```

diag_rasvpn /svc

Displays the RASVPN statistics.

```
        RASVPN Status: (11) RASVPN service - VPN ready
        RASVPN Nmb RasFct() Error: 1
        Modem Nmb Reset : 7
        PPP -ISP Nmb Dial:    11          (Einwahlversuche)
        PPP -ISP Nmb Connect: 10          (erfolgreiche Verbindungen)
        PPTP-VPN Nmb Login:   41          (VPN-Aufbau-Versuche)
        PPTP-VPN Nmb Connect: 30          (erfolgreiche VPN-Verbindungen)
        RASVPN Nmb RasFct() Error: 1      (letzter aufgetretener Fehlercode)
        Modem Nmb Reset : 7               (Anzahl der Modem-Resets)
```

It displays the number of ALU connections etc. that have occurred since the last boot of the ALU.

diag_rasvpn /stats

Displays the information regarding the RAS connection.

```
 RAS - 2 Active connections
 01.) 'RASPPTP'         Status='Connected'
        DevName='RAS VPN Line 0' DevType='vpn'
        Bytes S=10903, R=11056
        Frames S=199, R=258
        Compression I=100% O=107%
```

```
        Duration 221:46.766 [mm:ss.mss]
        Link (start):  28800 bps
 02.) 'RASMODEM'        Status='Connected'
        DevName='Hayes Compatible on COM2:' DevType='modem'
        Bytes S=62180, R=59404
        Frames S=1139, R=1144
        Compression I=0% O=0%
        Duration 223:52.944 [mm:ss.mss]
        Link (start):  28800 bps
```

Furthermore, Windows standard functions such as ipconfig are available.

Example of an existing GPRS connection:

ipconfig

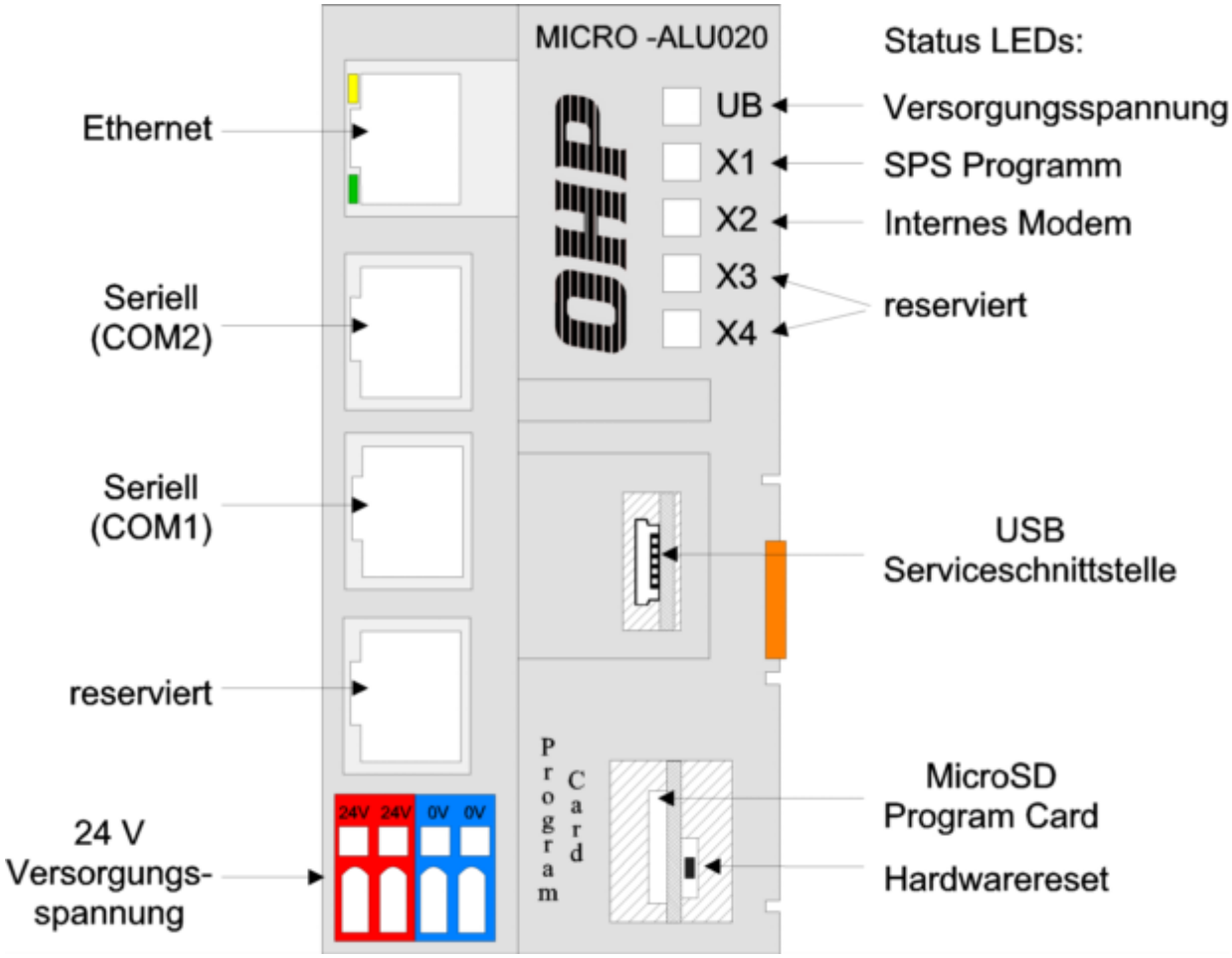
```
Windows IP configuration

Ethernet adapter [AX887961]:
         IP Address ........ : 0.0.0.0
         Subnet Mask ....... : 0.0.0.0

Ethernet adapter [SERIAL ON COM1:]:
         IP Address ........ : 10.209.197.137
         Subnet Mask ....... : 255.0.0.0
         Default Gateway ... : 10.209.197.137

Ethernet adapter [RAS VPN LINE 0]:
         IP Address ........ : 13.137.0.116
         Subnet Mask ....... : 255.255.255.255
         Default Gateway ... : 13.137.0.116

         DNS Servers........ : 10.74.83.22
                               193.254.160.1
```

Part III Module Description

1 Module Description ALU020

7.3 Interfaces

The interfaces and display elements are presented on the ALU020 as follows:



The ALU020-007 with GSM/GPRS modem, the aerial connection and the slot for the SIM card are on the top of the unit.

The SIM card is inserted, so that the chamfered edge points upwards and towards the front of the unit.

Position and Function of the Interfaces and Display Elements on the ALU020				
No.	**Description**	**Function**	**Type / Plug**	**Position**
	1 Ethernet, (delivery status 192.168.0.20)	Programming and communication interface	RJ 45	Front
	2 interfaces RS232	Communications interface, connection time receiver	RJ 45	Front
	Reserved for fieldbus connection		RJ45	Front
	Connection 24V supply voltage.	24V supply voltage ALU020 and I/Os	Cage clamp	Front
	Display Element		5 LEDs	Front
	1 USB interface	Interface for service use	1 USB socket	Front
	Micro SD slot	Medium for basic software and applications files	Micro SD socket	Front, behind protective cover
	1 SIM card interface (only ALU020-007)	SIM card for GSM / GPRS modem UEM 007	SIM card socket	Top
	1 Aerial interface (only ALU020-007)	Aerial connection for GSM / GPRS modem	SMA-f	Top
	Basic unit settings	Basic unit settings (new start, restart)	8 pole DIL switch	Rear

7.4 Power Supply

The ALU020 has an internal power supply input voltage range of 14-28 VDC. Using this the ALU020 the external periphery is supplied. For the periphery modules that are supplied via the K-bus, 1500mA is available. If an under voltage of > 14V occurs, the CPU's signal memory and the telegram buffer are stored to the Micro SD card zero-voltage buffer. The connection of the supply voltage is made via the supply plug. The polarity is labelled. Earthing of the unit is made via an earthing spring on the rear, which must rest on the DIN top hat rail.

7.5 Interface for an Optional GPS Time Receiver

The ALU020 has an optional connection possibility for a GPS time receiver GPSRCV from OHP. This is connected to the A020 via a serial interface with RJ45 format.

7.6 Serial RS232 Interfaces:

Pin No.	COM1 Design.	Signal Designation	COM2 Desig.	Signal Designation
1	DCD	Data Carrier Detect		
2	RXD	Receive Data	RXD	Receive Data
3	TXD	Transmit Data	TXD	Transmit Data
4	DTR	Data Terminal Ready		
5	GND	Ground	GND	Ground
6	DSR	Data Set Ready	+5VDC	Supply for GPS receiver (default switched off)
7	RTS	Request to Send	RTS	Request to Send
8	CTS	Clear to Send	CTS	Clear to Send

7.7 Micro SD Memory Card

The ALU020 has a memory card slot for a Micro SD card. The card slot is behind a protective cover labelled Program Card, which can be carefully opened with a small screwdriver. The supplied Micro SD card has a capacity of 2 GB.

The Micro SD card contains all the relevant data for the ALU020 for example the operating and running system, user application and telegram buffer. The ALU020 is delivered with a ready-to-use Micro SD card.

Beware: The Micro SD card should only be inserted and extracted in a zero-voltage state.

7.8 ALU020 Display Elements

The ALU020 has 5 LEDs which display the operating status of the ALU020.

No.	Function	Colour	Display
UB	UB OK	Green	Continuous
X1	User Prog.: Run, stop, error	Green	Continuous, off, blinks
X2	Status of internal modem	Green	Continuous, off, blinks
X3	Reserved	Green	
X4	Reserved	Green	

During booting the LEDs run through various blink conditions.

After a successful boot, the UB LED is continuously on.

If there is a user program as boot project stored on the Micro SD card, this will be started and the X1 LED will be continuously on, if not it remains off.

X2 is only used with an internal modem if no modem is inserted the LED remains off.

X3 and X4 are always off.

When an ALU with integrated modem for dial-up operation (GSM, Analogue, ISDN) is used the meaning of the X2 LED is as follows:

LED	Meaning
Off	No connection
Continuously on	Data connection, Password OK, IEC communication
Blinks slowly	Connection establishment initiated by the ALU
Blinks fast	Connection establishment initiated by the remote station (RING)
Blinks twice (500ms) - Pause	Modem initialisation problem
Blinks 3 times (300ms) - Pause	Modem no longer ready

When an ALU with integrated modem for GPRS operation is used the meaning of the X2 LED is as follows:

LED	Meaning
Off	No connection
Continuously on	Data connection, Password OK, IEC communication
Blinks slowly	Connection establishment initiated by the ALU
Blinks fast	Connection to the provider, creation of a VPN tunnel

7.9 ALU020 Operator Elements

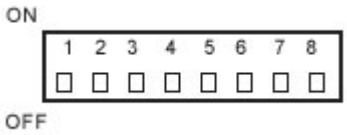
Reset Button

The hardware reset button is next to the Micro SD socket under a cover on the front side. The button is only meant for service use.

DIL Switch

The 8-pole DIL switch is used to set the start behaviour of the ALU020. The switch is on the rear of the unit.

Switch	Function
1	Reserved
2	Reserved
3	Reserved
4	Reserved
5	**ON = warm start, OFF = cold start**
6	**ON = COM1 internal, OFF = COM1 external**
7	Reserved
8	Reserved



Via switch 6 the COM1 interface can be transferred from the socket on the front side to the internal modem (e.g. for dial-up operation with IEC 60870-5-101). The COM1 interface on the front side cannot be used in this instance.

7.10 Module Placement

OHP recommends the following sequence for the modules:

ALU020	Controller
PWR024	Power supply
DEP…	Digital inputs…
DAP…	Digital outputs…
ADU…	Analogue inputs…
DAU…	Analogue outputs
TERM01	Bus termination

☞ **Note:** According to the corresponding module description, when using several DAUs it is necessary to insert a PWR024 module after each DAU.

☞ **Note:** The last module in the configuration is always a terminated with a TERM01 module.

7.11 Technical Data ALU020

Supply	
Supply voltage Power loss ALU020 Available current for I/O modules	14V – 30V < 5 W, without expansion modules max. 3500mA
Serial Interfaces	
Number Type, speed Connection	2 serial, asynchronous, V.24 level, max. 19.200 Baud RJ45, connection front side
Ethernet	
Number Type Connector	1 IEEE802.3, 100 Base T, 100 MBit/s RJ45, Connection underneath
USB	
Number Type	1 x USB 1.1 1 standard USB front side
Slot for Micro SD Card	
Number Type	1 Standard Compact Flash (Micro SD Card), 2GByte
CPU / Memory	
Processor type Memory Telegram buffer Operating system	Scaleable CPU board 32 MByte RAM / 32 MByte Flash 1 MB in Flash, no battery necessary Windows CE 6.0 real-time kernel
Time-of-Day Handling	
Synchronisation	Via an optional GPS Module connected to a serial interface
CPU Expansion Slot	
Number, type	1 slot for modem expansion card
Protection Class	
Protection class (IEC 60529) Protection class (IEC61140) Isolation	IP20 III EN60950, IEC 950
Environmental Conditions	
Ambient temperature in operation Storage temperature Relative humidity (IEC 68-2-1-1/2)	0°C to 60°C -25°C to 85°C To 95%, no condensation
Displays	
5 LED displays	1 LED UB OK 2 LED run, stop, fault 3 LED internal modem status 4 LED res. 5 LED res.
Mechanical Construction	
Format H x B x T	97 x 47 x 71 mm³