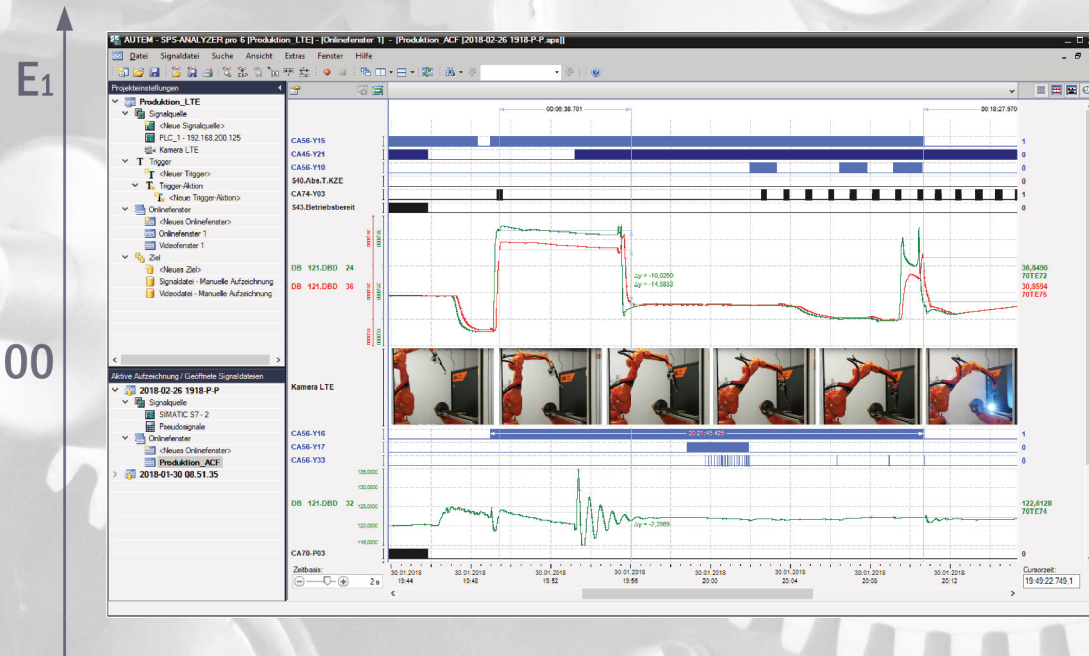# PLC-ANALYZER pro 6

PLC-Logic analysis in no time

Driver Addendum

PLC-driver

Siemens

SIMATIC S5 / SINUMERIK

Ethernet TCP/IP / PG-Interface (cycle precise)

PLC-ANALYZER pro **6 - Driver Addendum**

Siemens SIMATIC S5 / SINUMERIK - PG-Interface, cycle precise
Siemens SIMATIC S5 - Ethernet TCP/IP

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For references, suggestions and improvement suggestions we are always grateful. Please send these to AUTEM.

1st Edition 2022

Table of Contents

Signal source

Siemens SIMATIC S5 / SINUMERIK

This driver addendum describes the particularities of the following PLC drivers and gives you hints on the usage:

- Siemens SIMATIC S5 / SINUMERIK - PG-Interface - cycle-precise
- Siemens SIMATIC S5 - Industrial Ethernet TCP/IP

The driver "Siemens SIMATIC S5 / SINUMERIK - PG-Interface - cycle-precise" makes the acquisition of PLC signals through the programming interface of the PLC possible. In addition to normal operation the cycle-precise data acquisition is also possible. Chapter Cycle-precise recording describes the particularities of this recording mode. The driver „Siemens SIMATIC S5 - Industrial Ethernet TCP/IP" enables the acquisition of PLC signals via Industrial Ethernet (TCP/IP).

It is important, that you read through the driver addendum first, before you use a PLC driver. Please pay attention to the WARNINGS that advise you on possible dangers when using PLC-ANALYZER pro.

!	**WARNING**
	Errors that may occur in the automated facility, endangering humans or causing large-scale material damage, must be prevented by additional precautions. These precautions (e.g. independent limit monitors, mechanical interlocks) must guarantee safe operation, even in case of dangerous errors.

Installation

The PLC driver can be added to the project as a new signal source. If the driver you want is not yet in the list of available signal sources, you must first activate the license for the PLC-driver with the AUTEM LicenseManager on your computer.

Installing additional hardware

If you have already connected your programming unit or PC to the PLC via a serial cable or a TCP/IP network for the purpose of programming under STEP5 or an alternative programming software, you normally do not need to do anything else.

Otherwise, connect a free COM port (serial port) of your programming unit or PC to the PG interface of the PLC. Since the serial PG interface on the PLC works as a current interface (TTY/20mA), you need a suitable connection cable with integrated TTY converter (AUTEM order no. ANA1530) when connecting a normal PC.

Many Siemens programming devices (PGxxx) already have a serial 20mA interface, so that no special converter cable is required.

When using the Siemens SIMATIC S5 - Industrial Ethernet TCP/IP PLC driver, connect your PC to the TCP/IP network to which the PLC is connected. A normal Ethernet card in the PC is sufficient for connection to the TCP/IP network. A communication processor (CP) must be installed in the PLC to handle the data exchange. The CPs Siemens CP1430 TCP, VIPA CP143 TCP/IP and INAT S5-TCP/IP are supported.

Installing additional software

In addition to the PLC-ANALYZER pro basic module and the PLC driver no other software is necessary.

Configuration

Open driver settings to set important parameters for data recording. If you have added the driver to the project several times, you can set the properties individually for each individual driver.
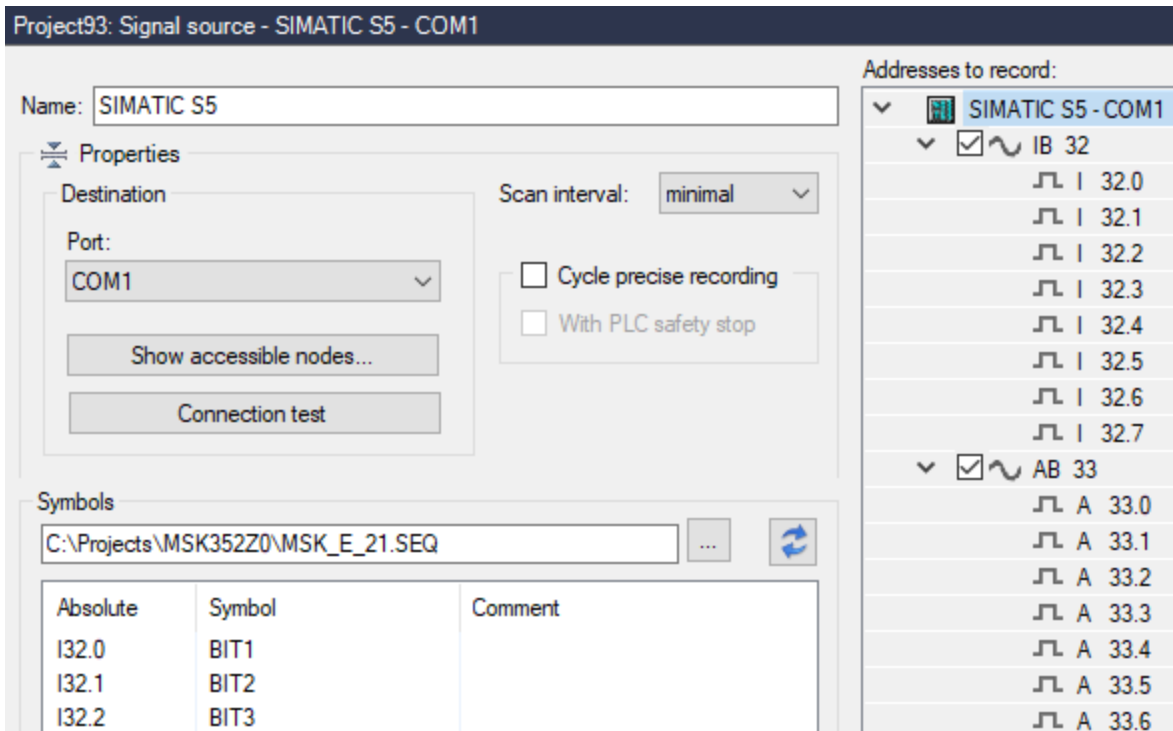
Configuration PG interface

Fig. 1-1 Settings Siemens SIMATIC S5

Choose a meaningful *Name* for the driver first. Specify under *Destination* the COM-Port (serial interface) of the PC, which is connected by a cable to the PLC.

For recording of very brief signal changes, activate Cycle precise recording. You can also specify, if for safety reasons the automation device should be stopped before and after the transfer of the acquisition modules.

Under *Scan interval* you specify the time interval at which measured values are read out from the PLC. A longer sampling interval can be selected for signal paths that are not time-critical, e. g. temperature. As a result, the generated signal files become smaller.

Show accessible nodes provides you with an overview of reachable nodes. Use *Connection test* to check whether a connection to the controller can be established successfully.

Under *Symbols,* select a STEP 5 symbol file (*.SEQ) to make the symbols available for address selection. This makes it possible to use symbolc identifiers when entering addresses. In addition to the absolute address, the symbolic identifier and comment are also displayed and stored in a signal- or project file.

After setting the communication properties, add the PLC signals to be recorded. When a symbol file is loaded, the signals to be recorded can be conveniently selected from the symbol list by double-click or drag and drop.
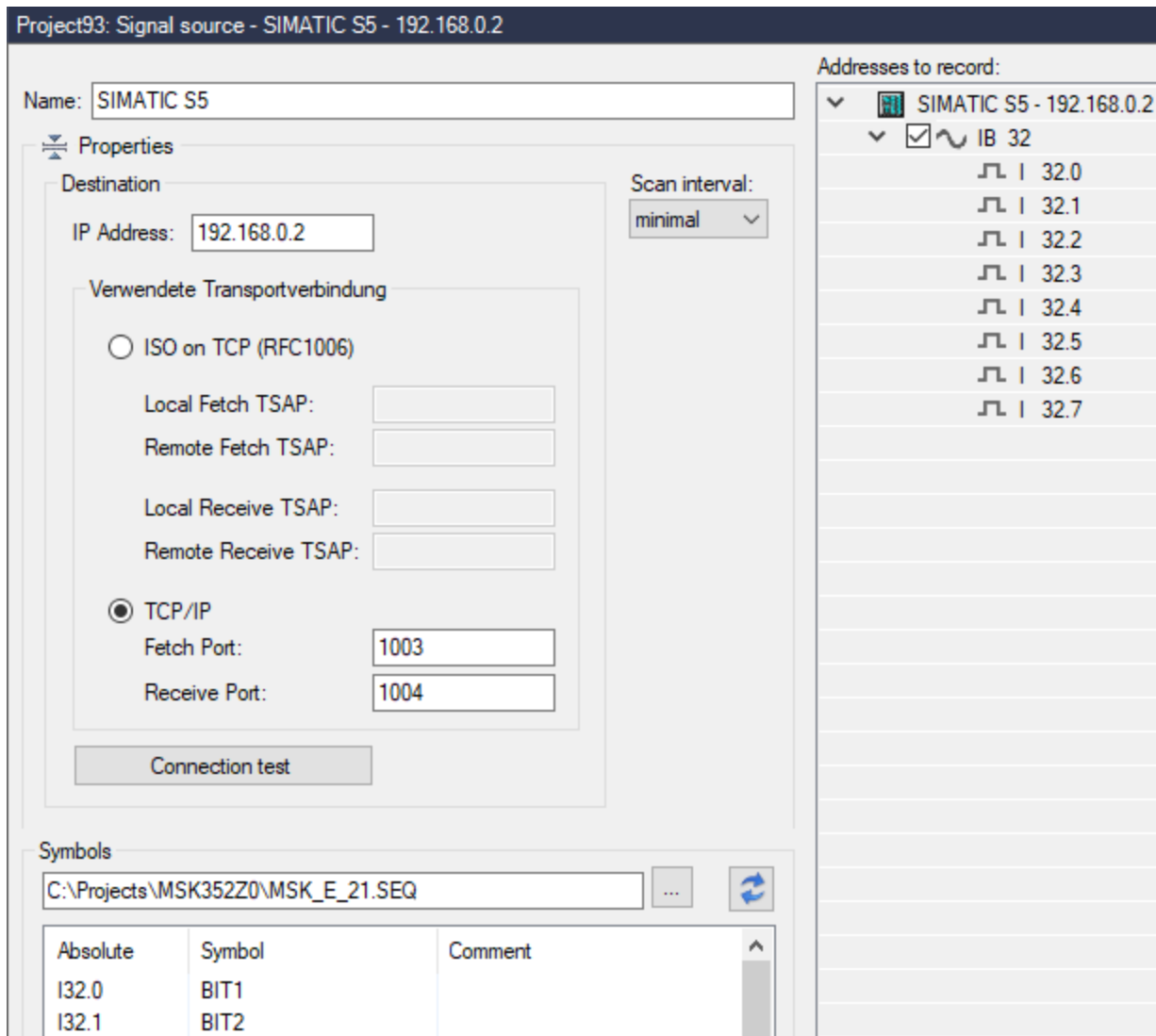
Configuration Industrial Ethernet TPC/IP

Fig. 1-1 Settings Siemens SIMATIC S5 - Industrial Ethernet TCP/IP

Choose a *Name* for the driver first, then specify under *Connection* the *IP-Address* of PLC. The IP-Address must be identical to the IP-Address used for initialization of the communication processor (Siemens CP1430 TCP, VIPA CP143 TCP/IP or INAT S5 TCP/IP).

Select the Used transport connection. Enter here exactly the parameters that were also used for the parametrized transport connections of the CP1430 (s. Configuration of CP for data acquisition).

Under *Scan interval* you specify the time interval at which measured values are read out from the PLC. A longer sampling interval can be selected for signal paths that are not time-critical, e. g. temperature. As a result, the generated signal files become smaller.

Use *Connection test* to check whether a connection to the controller can be established successfully.

Under *Symbols,* select a STEP 5 symbol file (*.SEQ) to make the symbols available for address selection. This makes it possible to use symbolc identifiers when entering addresses. In addition to the absolute address, the symbolic identifier and comment are also displayed and stored in a signal- or project file.

After setting the communication properties, add the PLC signals to be recorded. When a STEP7 or TIA project is loaded, the signals to be recorded can be conveniently selected from the symbol list by double-click or drag and drop.

Configuring of CP for data acquisition

The SIMATIC S5 PLC has to be equipped with a communication processor (CP) for data acquisition with PLC-ANALYZER via TCP/IP. Siemens CP1430 TCP, VIPA CP143 and INAT S5-TCP/IP are supported. The configuration of Siemens CP1430 TCP is exemplary described below. The configuration of the other CPs is similiar. Refer to the user manual of the CP for further information.

Initialization of Siemens CP1430 TCP

The CP1430 is parameterized with Siemens STEP 5 configuration software "COM1430 TCP/IP". Go to "COM1430 TCP/IP" in STEP 5 if you want to configure CP1430 TCP or determine the settings.
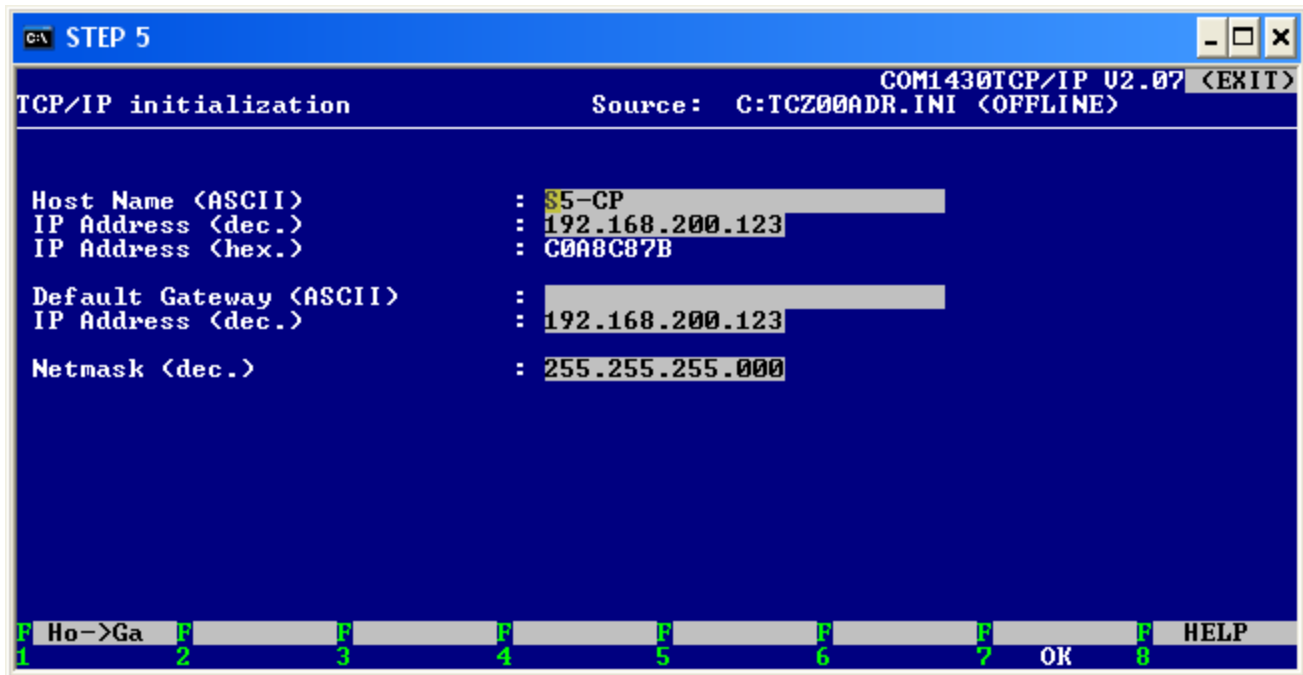
Fig. 1-3 CP1430-Initialization

Choose *CP Init* in menu *Edit* to determine the IP address of the CP. You can select an IP address here, if you did not already configure the CP. All settings must be transferred to the CP by choosing *FD -> CP* in menu *Transfer*

Create transport connection

Two transport connections with job type "Fetch" and "Receive" are necessary for data connection between PC and CP1430. These connections can be either of type RFC1006 (ISO on TCP) or TCP.

Create an RFC1006 connection

To create an RFC1006-connection choose *Connections - Transport Conn. (RFC1006)* in menu *Edit*.
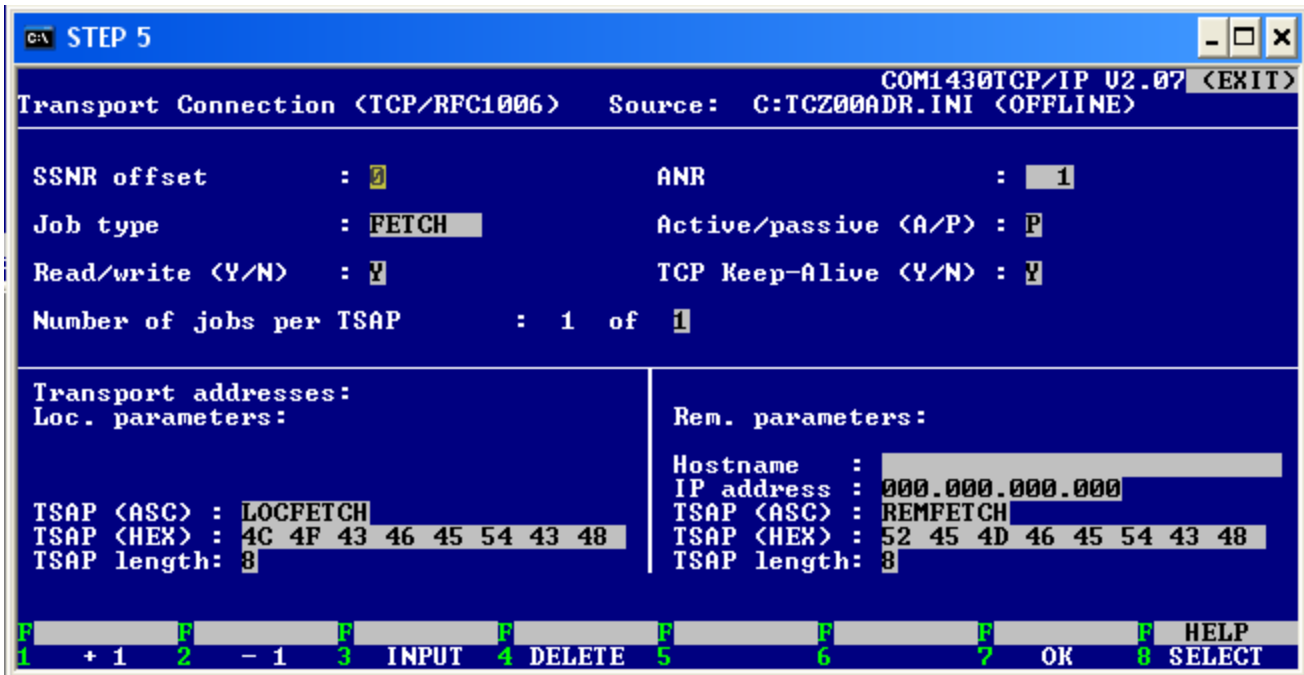
Fig. 1-4 Create an RFC1006-Connection „Fetch"

Choose "Fetch" as job type. Enter a unique TSAP under *Transport addresses* for the local and remote site.
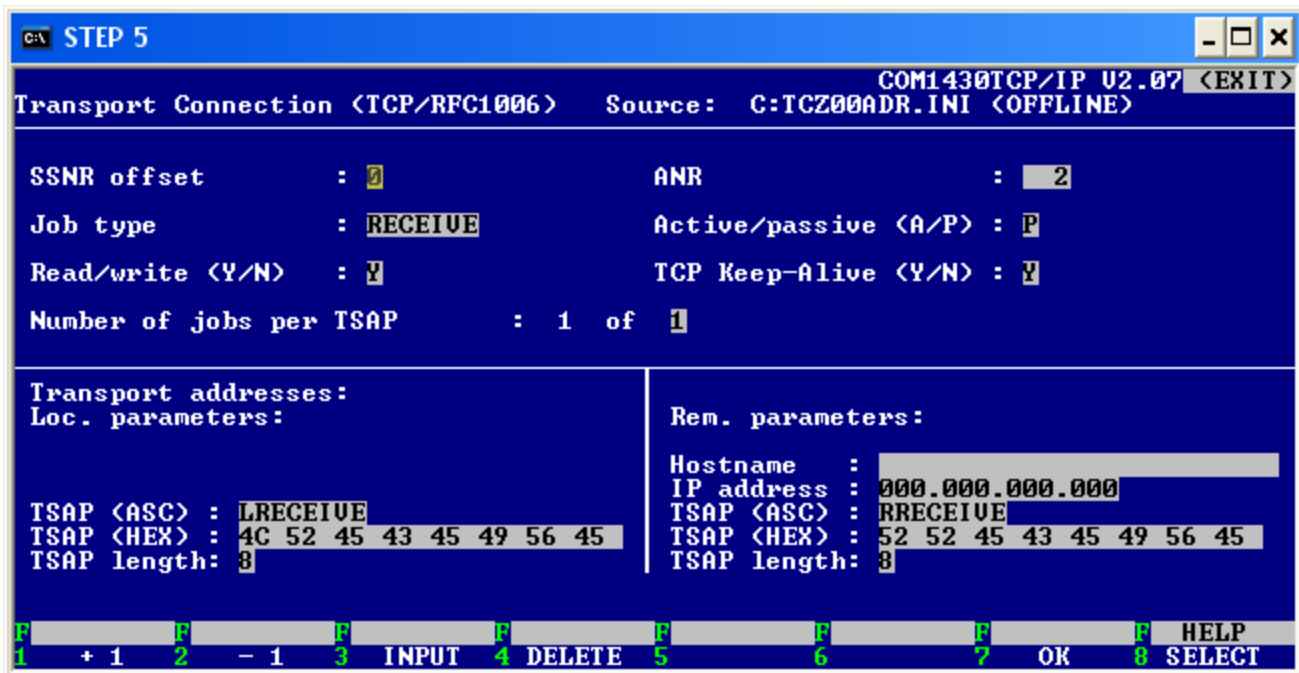
Fig. 1-5 Create an RFC1006-Connection „Receive"

Create another RFC1006-connection with job type "Receive". Enter unique TSAPs here, too

Create a TCP connection

To create a TCP-connection choose *Connections - Transport Conn. (TCP)* in menu *Edit*.

Fig. 1-6 Create a TCP connection „Fetch"

Choose "Fetch" as job type. Enter an unambiguous port number for the local site.
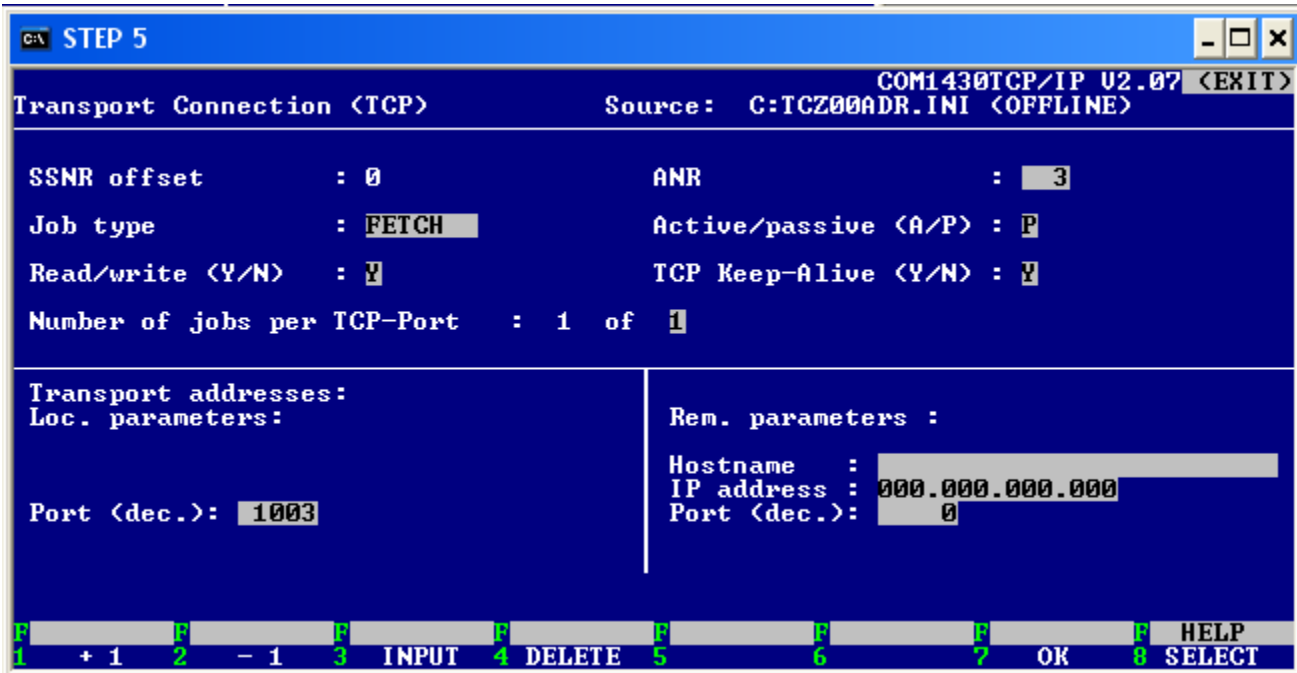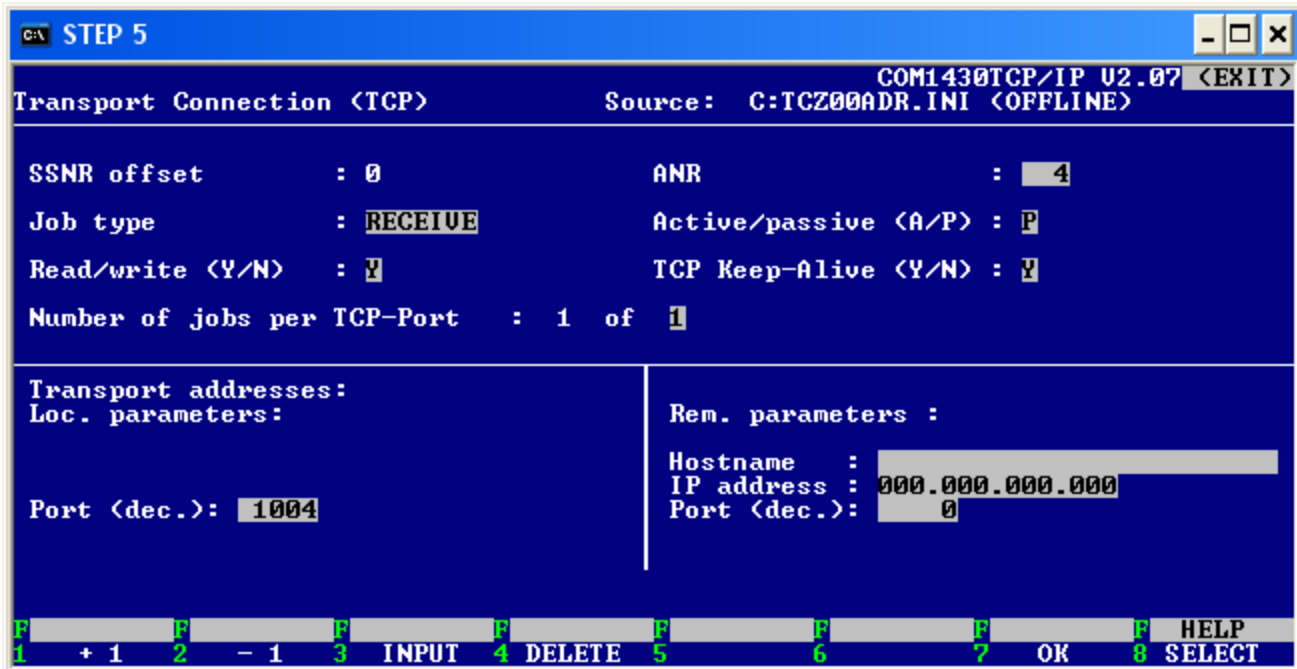

Fig. 1-7 Create a TCP connection „Receive"

Create another TCP-connection with job type "Receive". Enter an unambiguous port number here too.

Data acquistion

Supported PLC models and CPUs

The following models of the SIMATIC S5 family are supported by the AS511 driver:

PLC	CPU	Particularities
90U		No acquisition of PW,
		No cycle-precise acquisition
95U		No acquisition of PW
95F		No cycle-precise acquisition, no acquisition of PW
100U	100, 102, 103	Cycle-precise acquisition only with CPU 103
101U		No cycle-precise acquisition
115U	941, 942, 943, 944, 945	
115F	942	No cycle-precise acquisition
135U	921, 922, 928, 928B	
150U		No cycle-precise acquisition
155U	946, 947, 948	

Table 1-1 Overview of the supported SIMATIC S5 models

Other automation devices and CPUs from the S5 family are generally compatible with PLC-ANALYZER pro, but have not been explicitly tested.

A communication processor (CP) is required to record data through a TCP/IP network. The following CPs are supported by this PLC driver:

- Siemens CP1430 TCP
- VIPA CP143 TCP/IP
- INAT S5-TCP/IP

Recordable PLC addresses

The following table shows the recordable addresses and the corresponding address syntax:

Syntax	Address type	Example
Qx.z	Output byte x, bit z	Q32.4
QBx	Output byte x	QB9
QWx	Output word x	QW14
QDx	Output double word x	QD98
Ix.z	Input byte x, bit z	I17.0
IBx	Input byte x	IB127
IWx	Input word x	IW12
IDx	Input double word x	ID124
Fx.z	Flag byte x, bit z	F3.7
FBx	Flag byte x	FB250
FWx	Flag word x	FW24
FDx	Flag double word x	FD134
FWAx	Flag word analog x	FWA26
PWx	I/O word x (only input)	PW214
Sx.z	Special flag x, bit z	S1010.1
SYx	Special flag x	SY2027
SWx	Special flag word x	SW1423
SDx	Special flag double word x	SD1028
Tx	Timer x	T2
Cx	Counter x	C5
yDLx	Left data byte x from DB y	20DL15
yDRx	Right data byte x from DB y	21DR53
yDWx	Data word x from data block y	12DW5
yDDx	Data double word x from DB y	27DD0
yDXx	Data word x from DX-module y	22DX15

Table 1-2 Address syntax SIMATIC S5

> **NOTE**
>
> ❯❯ The automation devices of the SIMATIC S5 family allow only byte-oriented data acquisition. PLC-ANALYZER pro automatically converts a given bit address to a byte address. All bits are available for display.

Number of recordable addresses

Addresses from up to 250 signal sources can be acquired. With the PLC driver "Siemens SIMATIC S5 / SINUMERIK - PG interface - cycle-accurate" a maximum of 20 addresses can be acquired simultaneously and with the PLC driver "Siemens SIMATIC S5 - Industrial Ethernet TCP/IP" a maximum of 16 million addresses can be acquired simultaneously.

The term "address" means a byte- or a word-address. The recording of a double-word-address results in transferring of 2 words, so 10 double-word-addresses can be recorded.

Time behaviour and particularities

> **»**
> ### NOTE
> Acquiring data with PLC-ANALYZER pro 6 results in a small increase in cycle time in the automation device to the same manner as it happens with STEP5 in the operating mode STAT VAR.

The intervals between scan transfers from the SIMATIC PLC to the computer are depending on the PLC CPU and the number of acquired signals.

For the SIMATIC S5-115U (CPU942) and the 95U the interval for a byte is approximately 30 ms, i.e. for a cycle time > 30 ms there is one scan for each cycle. For a longer PLC cycle time data transfer is synchronized with the PLC cycle.

For a shorter cycle time the computer does not obtain a scan for each cycle, resulting in a partial loss of information. In the normal acquisition mode this loss can be made up by repeated measurements of the signals in question.

If you request more signal addresses than one byte, the minimal transfer interval increases by about 4 ms per byte.

The scan interval for the S5-155U has been fixed in the automation device by Siemens to 150 ms. The CPU 921 (S processor 135U) is the second slowest CPU with regard to the transfer rate; about 70 ms scan interval for the first byte.

Cycle-precise recording

> **!**
>
> ### WARNING
>
> For cycle-precise acquisition PLC-ANALYZER pro programs a small extension to the PLC program in the connected automation device. Please pay attention to the fact that an effect on the operation of the automation device or the PLC program cannot be completely ruled out.

During cycle-precise signal acquisition a limited number of signals are acquired in a circular memory within the PLC. The selected signals are stored in the circular memory during each PLC cycle.

Acquisition will only be done trigger-controlled. After triggering, the acquired signals are transferred to the PC and are saved as a signal file. The so created signal file can be displayed and evaluated at any time. Live display is not possible.

Input of addresses

For cycle-precise acquisition you can acquire up to 8 addresses (byte or word values) simultaneously. This restriction is a result from the limited storage capacity of the PLC. The fewer addresses you enter, the more cycles can be acquired in one run.

Input of trigger condition

A trigger condition must be entered for cycle-precise acquisition. In contrast to the other acquisition modes only two AND blocks are available for entering the trigger conditions. For each AND block you can insert a maximum of 8 bit values or 2 analog values in the trigger combination (one analog value corresponds to 4 bit values).

Start acquisition

Select the option *Cycle-precise acquisition* in the *Properties* windows of the PLC driver.

> **!**
>
> ### WARNING
>
> It is absolutely necessary that the system in a safe state before making any modifications. With the setting "With PLC safety stop" PLC-ANALYZER pro switches control of module transfer (or modification) into the STOP state. The operation after the end of the recording will be analogously.

Now start the acquisition. The modules are transferred either during operation or after control stop, depending on the setting you have made in the PLC driver *settings.*
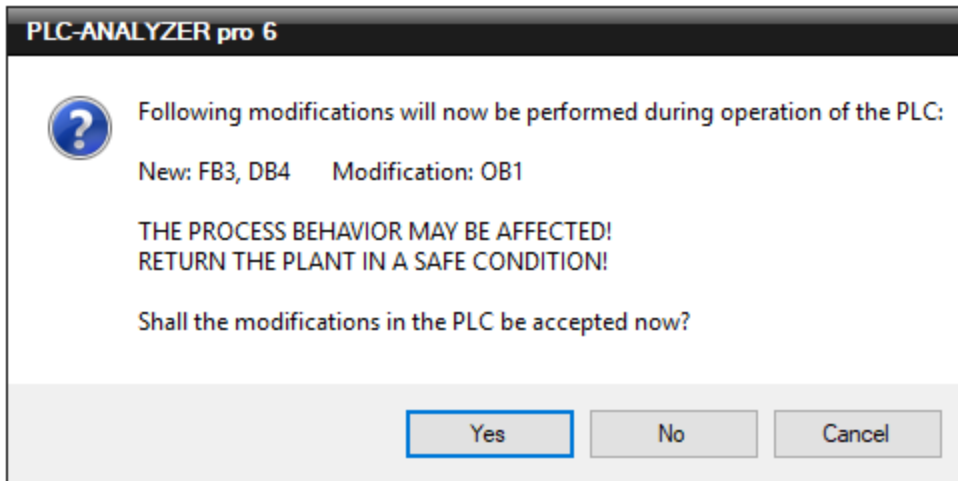
One of the following message windows appears:

Fig. 1-8 Message before modifications in the PLC for pre-setting "No PLC safety stop"
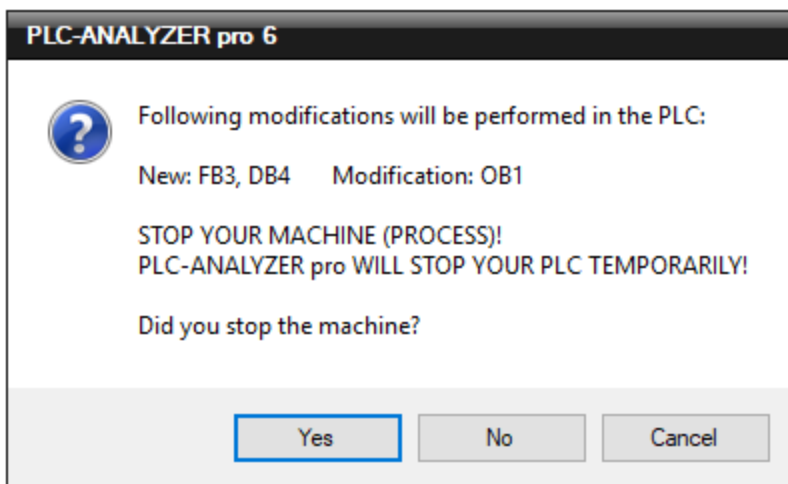

Fig. 1-9 Message before modifications in the PLC for pre-setting "With PLC safety stop"

Confirm with *Yes* only after you have stopped the process or after it is in a safe condition. Make sure, that injury or damage cannot happen by affecting control operation!

PLC-ANALYZER pro searches in the PLC for a free module number and creates a function module and a data module for data recording. In addition, a call to the new function module is appended to the end of OB1.

The controller is now in RUN condition or is switched to RUN condition. Cycle-precise acquisition will start.

The displayed signals serve as a status display for cycle-precise recording. Their meaning is shown in the following table:

Signal	Meaning
Trigger	Signals, if the trigger condition is fulfilled.
Mem full	Shows that the circular memory is full.
Transfer	The circular memory is transferred from the PLC to the PC and a signal file is created.
T1 active	The trigger combination from AND block # 1 is activated.
T2 active	The trigger combination from AND block # 2 is activated.

Table 1-3 Status display cycle-precise recording S5

Recording is stopped with *Stop acquisition*. You should now stop your system (process) or put the system into a safe condition. Removal of the modifications is now done analogously in the stop state or online. One of the following message windows appears:
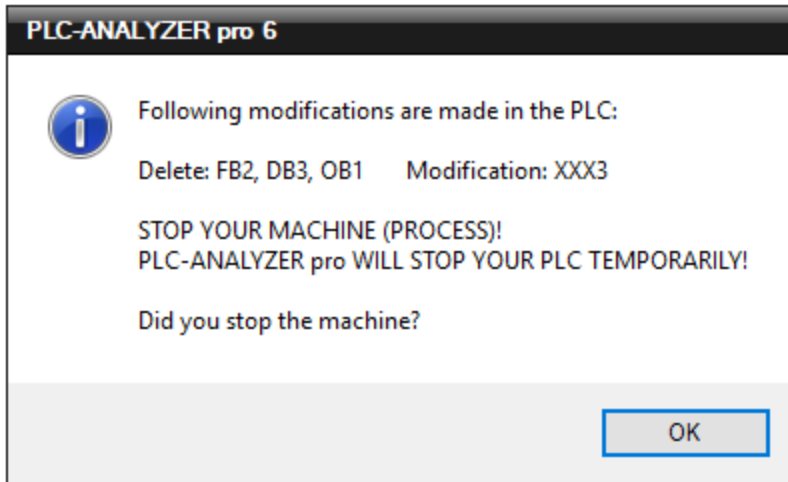

Fig. 1-10 Message before modifications in the PLC for pre-setting "With PLC safety stop"
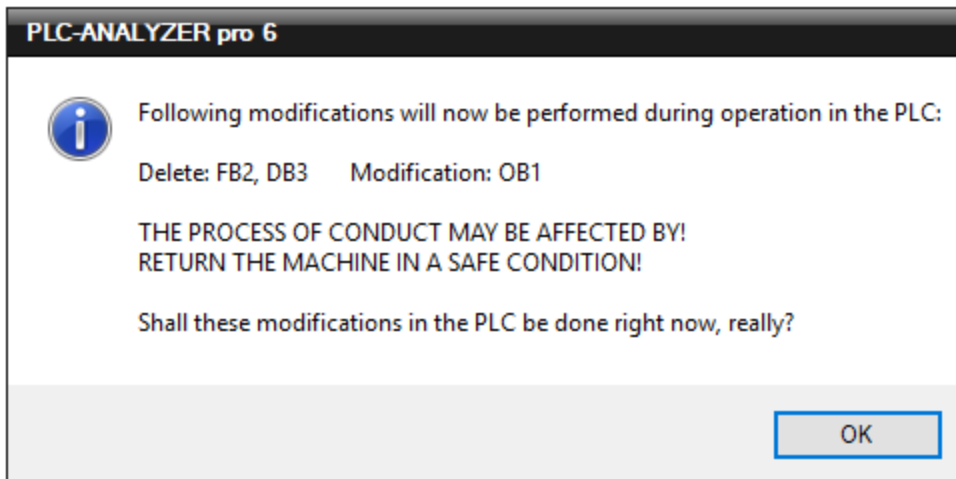

Fig. 1-11 Message before modifications in the PLC for pre-setting "No PLC safety stop"

Confirm the message after you have stopped your system or put it into a safe state. The original state in the PLC is restored now.

After the end of acquisition the last signal file created is automatically opened for display. The time base is chosen in such a way, that the entire file fits onto the screen.

Particularities in signal display and analysis

Evaluation of cycle-precise acquired signal files is nearly identical to normal signal files. However no time stamp is generated during signal recording, so no exact time is assigned to the data. Therefore the time will be specified in cycles. The time base is „mZP" (milli cycle per pixel) resp. „ZP" (cycle per pixel).

Example: A time base of 100 mZP means a PLC cycle is 10 screen pixel wide.