#### Remote control SIPROTEC 4 Devices over analog INSYS–Modems

### Data transmission is done with V.92 communication using 57600 Baud and the data format 8N1.

#### Introduction

The possibilities of remote operation of SIPROTEC devices are numerous. Assistance for the selection of "Your" remote operations concept may be found in the document "General Information" in the Internet under:

#### <u>www.SIPROTEC.com</u> / Applications / Remote control.

This document contains a detailed description regarding the secure remote operation of SIPROTEC 4 devices with DIGSI 4 (from version 4.60 + SP1) via the modem INSYS Pocket 56k (desktop device in the office) and INSYS Modem 56k (rail-mounted system in the substation).

#### **Operational concept**

The figure below shows a proven hardware configuration for V4 protection devices in the substation, i.e. an optical star configuration via star-coupler for devices with optical interface, or a RS485 bus configuration for devices with RS485 interface. To obtain optimal speed and security for the data transfer, the remote communication is done with the standard data format 8N1 together with data compression and error correction. A Notebook PC may be connected temporarily to the mini-star coupler ("A1") for local operation. The modem at the optical input ("A2") is automatically disconnected. For local operation without a mini-star coupler ("A1") the modem must be disconnected from the RS232 FO converter.



Figure 1: Hardware configuration of a remote operation of SIPROTEC 4 protection devices





The application described here was successfully tested under Windows XP SP2 using DIGSI 4.80 + SP1. The following modems were used during testing: Office modem: INSYS Pocket 56k (Desktop device with plug in power supply) Substation modem: INSYS Modem 56k (rail-mounting device with external wide area power supply).

As numerous problems occurred regarding the change of the data format in the office modem in the past, special modem drivers are now available for the remote operation with DIGSI 4. After the installation of these modem drivers, the office modem can connect to all INSYS-modems with e.g. 57,6 kB / 8N1 or 9,6 kB / 8E1 or 19,2 kB / 8E1 for operation of the protection device. The modem driver used here, **INSYS Modem 56k – V.92 57600 8N1.inf** may be found in the Internet under:

#### www.SIPROTEC.com / Accessories / 7XV5820 / ...

#### The security concept

The security concept regarding interference on the entire transmission line as well as unauthorised access to protection devices has a high priority and regard has been taken of this with various measurements.

The transmission security on the link is ensured by an efficient error correction procedure. The settings of the modems take regard of this concept.

The system may be protected from unauthorised access by the necessary modem settings with password protection as well as automatic call-back.

#### The most important general rules

The following rules must be adhered to when operating from remote via a modem:

- For remote operation under Windows XP Prof. only DIGSI 4.60 + SP1, DIGSI 4.7x, DIGSI 4.80 + HF2 or newer DIGSI-Versions may be used.
- Only install the exact driver specified for the modem type and operating system in Windows.
- Always use the modem drivers recommended in the application descriptions. These may be downloaded from the Download-Area under <u>www.siprotec.com</u>.
- The transmission rate of the telephone line <u>must</u> always be the same or higher than the set baud rate of the substation modem and the protection devices (telegram gaps).
- The (telegram)-gap tolerance of the SIPROTEC 4 devices must be set to 1.0 sec. .
- Baud rate and data format of the office modem <u>must</u> be set exactly the same in the system as well as the DIGSI 4 modem driver.
- ATTENTION: Changes which are entered into the Windows-Registry will only be activated when the PC is <u>re-booted</u>.
- The baud rate and data format of the substation modem as well as of all protection devices must be the same.
- Each protection device in the substation <u>must</u> have a unique address between 1 and 254.



#### Establishing a project and substation

The new project in DIGSI 4 with substation files, feeder files and protection devices may be retrieved from an archived project or may be a newly created project. The procedure is described in the SIPROTEC system manual.

📓 DIGSI Manager - Region London		
<u>File Edit Insert Device View Option</u>	<u>W</u> indow <u>H</u> elp	
D 🗃 🔏 🛍 🛍 🚝 🚟 📰 🗄	🗈 < No Filter >	
Region London C:\Siemens\D	gsi4\D4proj\Region_L	
Region London     Substation East	Feeder 1 🦳 Feeder 2 🦳 Feeder 3	in the second se
Feeder 1	DIGSI Manager - Region London	
⊕ · · · · · · · · · · · · · · · · · · ·	File Edit Insert Device View Options Window	
		< No Filter >
	🗃 Region London C:\Siemens\Digsi4\D4	proj\Region_L
	Region London     Substation East     Feeder 1     Feeder 2     Feeder 3     Substation West     Feeder 1     Feeder 2     Feeder 1     Feeder 1     Feeder 2     Feeder 1     Feeder 2     Feeder 3	.2 👔 7SJ633 V4.6
Press F1 to get Help.		

Figure 2: SIPROTEC 4-protection devices in the substation manager of Digsi 4

Before the required settings for the remote operation are done, the local connection to all protection devices should be tested via the central interface (e.g. at the star coupler) (see Figure 1)

Please also take note of the documents "Central Control" in the Internet under

www.SIPROTEC.com / Applications / Remote control.

#### Note:

- The service interfaces of all protection devices must be set to **57600 Baud** with the data format **8N(one)1**.
- Each device must have a **unique device address** from 1 254.
- All service interfaces must have a "gap tolerance" of 1.0 second.



#### Installing the modem drivers

Before installing and setting of the modems in DIGSI 4, the modem must be installed in Windows. The original INSYS-modem driver is located on the CD supplied with every modem and must be installed. If this is not done, Windows XP tries to install the driver anew after each new start of the PC. The driver is not used in this application, and may remain in the pre-settings.

For the remote operation of the SIPROTEC 4 devices in this application, a special modem driver is downloaded from the "SIPROTEC Download-Area", unzipped and subsequently installed. This driver may be found in the Internet under:

#### www.SIPROTEC.com / Accessories / 7XV5820 / INSYS-Driver.exe

The exe-file automatically unzips itself to C:\Siemens\INSYS-Modem\... and contains all special INSYS-modem drivers for the remote operation of SIPROTEC-devices in DIGSI 4. To install the required modem driver, please proceed as follows:

In the Windows Control Panel choose "Phone- and Modem Options" by double-click on the icon.

With "Add"..." a new modem driver is installed



hone and Modem O	ptions		?
Dialing Rules Modems	Advanced		
The following	g <u>m</u> odems are installed:		
Modem		Attached To	
🇆 Agere Systems Al	C'97 Modem	COM3	
	Add	Pamoura Propa	dian
		Zeniove Prope	nies



HELP\_DIG48\_SIP4\_INSYS\_56K\_57600\_8N1\_EN.DOC

in Windows.



The modem has to be selected manually.

Check "Select modem" (no automatic detection)"



Manufacturer

(Standard Modem Types)

😭 This driver is digitally signed

Tell me why driver signing is important

Add Hardware Wizard

Install a new modem from

"Have Disc..."

Press "Next >".

Press "Next >".

Select the applicable drive, e.g.. "C:\"

"Browse..." for the modem driver on the disc.



Models

Communications cable between two computers Parallel cable between two computers 🖼 Standard 300 bps Modem Standard 1200 bps Modem

< Back

Next >





~

v

Have Disk.

Cancel



The modem driver is located in the path, into which it was unzipped, e.g. **"C:\Siemens\INSYS-Modem\...**".

Mark the special driver file INSYS Modem 56k – V.92 57600 8N1.inf and



"Open"

Continue with "OK"

Mark the special driver

press "Next >".

and

INSYS Modem 56k - Direct 9600 8E1







Select the serial port, e.g. "**COM1**" to which the modem will later be connected.

This Windows XP warning may be

ignored. The driver was tested with

Press "Next >"

Windows XP.

Continue with

"Continue anyway"









Complete the installation with "Finish"



#### Modemtreiber Einstellen

In the overview of the installed modem drivers, the driver that has just been installed is visible.

The settings of the selected modems may be checked and changed with "**Properties**".

When clicking on the tag "**Modem**" a window appears in which the "volume" and the "maximum baud rate" to the terminal device may be changed.

The pre-setting of **57600** Baud is not changed.

The selection **"Wait for the dial tone before dialling"** is **deactivated**.

Under the tag	("Advanced	no further	"initialization
commands"	have to be en	tered.	

Additional commands are later entered in DIGSI 4

Further settings <u>have</u> to be done under "Change default preferences ..."

Phone and Modem Options	? 🔀
Dialing Rules Modems Advanced	
The following modems are installed:	
Modem Attached To	
Agere Systems AC'97 Modem COM3	
INSYS Modem 56k - V.92 57600 8N1 COM5	
Add <u>R</u> emove Prop	erties
OK Cancel	Apply

INSYS Modem 56k - V.92 57600 8N1 Properties	? 🔀
General Modem Diagnostics Advanced Driver	
Port: COM5	
Speaker volume	
Off , , , High	
Maximum Port Speed	
57600	
Dial Control	
Wait for dial tone before dialing	
OK	Cancel

NSYS Modem 56k - V.92 57600 8N1 Properties	? 🔰
General Modem Diagnostics Advanced Driver Extra Settings Extra initialization commands:	
Change Default Preferences	
ОК	Cancel



Power Transmission and Distribution Energy Automation

		INSYS Modem 56k - V.92 57600 8N1 Defaul ? 🔀
Settings in the wi	ndow " <b>General</b> ":	General Advanced
The " <b>Call prefer</b> e	ences" do not have to be changed.	Disconnect a call if idle for more than       30       mins         Cancel the call if not connected within       60       secs
Set the "Data Co	nnection Preferences"	Data Connection Preferences
Port speed 57 Data protocol Sta Compression En Flow control No	600 andard EC abled one	Port speed: 57600 V Data Protocol: Standard EC V Compression: Enabled V Flow control: None V
Settings in the wi	ndow " <b>Advanced</b> ":	General Advanced
Set the " <b>Hardwa</b> Data bits Parity Stop bits Modulation	re Settings" 8 None 1 Standard	Hardware Settings          Data bits:       8         Parity:       None         Stop bits:       1         Modulation:       Standard
Close all windows	s with " <b>OK"</b> .	

#### Attention:

During every dialling process these settings of the system modem drivers are used for initialisation purposes of the office modem and must be done exactly as shown here.

"Restart" the PC



OK

Cancel





#### Creating a phone book

The phone book is located within the project. An address (telephone number) must be available centrally in this phone book for each modem. After double-clicking on the icon "Phone book", the phone number of the office and station modem can be entered with their names, using the button "New" (refer to the screen shot below).

	Properties - Address		
The country and area codes (without 0) must be entered.	Address   <u>N</u> ame: National gode:	Office Modem	
	Area code. Number:	4331234	
Properties - Address		×	
Address   <u>N</u> ame:  Su	ubstation East		
National <u>c</u> ode: 44	4		
Area code:	71		Cancel Help
Nu <u>m</u> ber:	559876		
ок		Cancel Help	

If all the windows were closed with **"OK**", the settings can be checked in the overview.

After closing this window with "**OK**", all the settings are saved in the phone book.

Address		
<u>N</u> ame:	Substation West	
National <u>c</u> ode:	44	
<u>A</u> rea code:	171	
Nu <u>m</u> ber:	4556543	





#### Establishing an office modem in DIGSI 4

When the modem driver for the INSYS-Modem has successfully been installed, and the telephonebook has been filled out, the office modem may with all its settings be established in DIGSI 4. <u>This modem then establishes the connection to all analog INSYS-substation modems with 57600 Bd</u> and the data format 8N1. For the connection to other substation modems, the required Help Files are available.

By double-clicking on the icon "Modems" in the project, the office modem is established with "New".

The modem is assigned a "**Name**", e.g. "**Office modem**".

Different office modems must have unique names, e.g. **Office 9600 8E1, Office 57600 8N1** etc...

Under **"initialise modem"** the command **ATM0** may be used to switch off the modem speaker. No other commands should be entered here.

Select the "Modem driver" already installed INSYS Modem 56k – V.92 57600 8N1

The **"Assigned address"** is selected from the **"Telephone-book"**.

News	Office Medem	na eksin eksin eksin eksin eksin eksin eksin eksin eksin	10.0210.0
<u>N</u> ame:	јопісе модет		
<u>I</u> nitialize modem:			
Modem <u>d</u> river:	INSYS Modem 56k - V.92 5	7600 8N1	•
	<u>P</u> roperties		
	Office Modern	44 20 4331234	
Assigned <u>a</u> ddress:	Properties	44 20 4001204	

The following settings under "Properties" correspond to those, which were already selected during installation of the modem driver. They should be checked, and if required, changed here.

#### Properties Office modem

Settings in the window "General":

The "Call preferences" do not have to be changed

#### Set the "Data Connection Settings"

Port Speed
Data protocol
Compression
Flow Control

57600 Standard EC Enabled None

General Advanced			
Call preferences			
Operator assiste	d (manual) dial		
Disconnect a ca	all if idle for more th	an 30	mins
<u>C</u> ancel the call i	if not connected w	vithin 60	secs
<u>P</u> ort speed:	57600 Standard EC	*	
D <u>a</u> ta Protocol:			
D <u>a</u> ta Protocol: Comp <u>r</u> ession:	Enabled	~	
D <u>a</u> ta Protocol: Comp <u>r</u> ession: <u>F</u> low control:	Enabled None	*	



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The settings under the tab "Advanced" remain the same.

Under "**Terminal Window**" no checks are made as no password and automatic call-back is required for operation.

Nothing is changed under "Hardware Settings"

8
None
1
Standard

Close all windows with "OK".

Note: If the settings under "General" and "Advanced" are not correct, these must first be corrected in the modem driver which may be found in the "Control Panel".

After a **Restart** of the PC the corrected settings should be checked and altered if required.

#### Establishing a substation modem in DIGSI 4

For each substation modem, a "substation modem" has to be established in DIGSI 4, as the telephone number relating to the substation has to be saved together with the modem settings. By double-clicking on the icon "modems" a substation modem is established with "**New**".

A "**Name**" is assigned to the modem e.g. "**Substation West**".

Under "Initialise modem" the complete initialisation string AT &D0 E0 S0=1 &W is entered. (Spaces between the commands are permissible). The fixed baud rate of 57600 Bd is set by the modem driver (AT \*S9).

Under **"Modem driver"** the same settings are selected for the office modem.

The **"Assigned Address"** is selected from the **"Telephone-book"**.

Properties - Modem			
Settings			
<u>N</u> ame:	Substation West		
Initialize modem:	AT &D0 E0 S0=1 &W		
-			
Modem <u>d</u> river:	INSYS Modem 56k - V.92	57600 8N1	-
	Properties		
Assigned address:	Substation West	44 171 4556543	
Assigned <u>a</u> ddress.	, Prosting 1		
	Properties		
ок		Cancel	Help

The initialisation commands mean the following

- &D0 the control line DTR is ignored as it is not supported by the protection device
- E0 Echo off
- S0=1 Accept call after the first ring tone (5 are possible)
- &W settings are secured in the non-volatile storage



Teminal Window —	nal window before dialio	3
Bring up termi	nal window a <u>f</u> ter dialing	
Hardware Settings -		
<u>D</u> ata bits:	8	*
<u>P</u> arity:	None	~
<u>S</u> top bits:	1	~
Modulation:	Standard	*

#### Properties substation modem

Settings under the tab "General"

The "Call preferences" do not have to be altered

#### Set the "Data Connection Preferences"

Port speed Data protocol Compression Flow control 57600 Baud Standard EC Enabled None

Under the tab " made or not cha	<pre>\dvanced" the settings have to be nged</pre>
Data bits	8
Parity	None
Stop bits	1
Modulation	Standard

No check is made under "**Terminal Window**" before / after dialing".

ΔII	windows	are	closed	with	"OK"
Π	williuow5	aie	CIUSEU	VVILII	UN

When the modems have all been established, they may be marked in the overview and checked or changed if required.

The substation modem can also be initialised here (see next chapter).



### Power Transmission and Distribution Energy Automation

Call preferences			
Operator assiste	d (manual) dial		
Disconnect a ca	all if idle for more th	ian 30	mins
<u>C</u> ancel the call	if not connected w	vithin 60	secs
Data Connection Pre	ferences 57600	~	
	Others does d EC	4.4	
D <u>a</u> ta Protocol: Comp <u>r</u> ession:	Standard EC Enabled	*	
D <u>a</u> ta Protocol: Comp <u>r</u> ession: <u>F</u> low control:	Standard EC Enabled None	* *	

INSYS Modem 56k - 1	V.92 57600 8N1 Conn	e ? 🗙
General Advanced		
Teminal Window — Bring up temin Bring up temin	nal window <u>b</u> efore dialing nal window after dialing	
Hardware Settings -		
<u>D</u> ata bits:	8	✓
Parity:	None	✓
<u>S</u> top bits:	1	<b>~</b>
Modulation:	Standard	✓
	ОК	Cancel





#### Initialising the substation modem

The substation modem has to be connected to the DIGSI PC with a standard modem cable once for initialisation purposes.

When operation takes place with password protection or automatic call-back, entereing the password or call-back number with the Windows program "Hyper Terminal" should be preferred, as the echo is switched off after initialisation with DIGSI 4, and the entries are no longer visible.



In the window "**Properties modems**" the desired modem should be marked and initialised with the button "**Initialise**"

If the initialisation was successful, the settings are permanently stored in the modem and remain there even in the case of a power failure.



Note: If error messages appear in the "**Report**" window, these may be caused by the modem not being connected properly, or no check-back signals being received from the modem. Use the modem cable supplied, carry out another re-set and check the modem settings in the system and modem drivers.

To check whether all settings of the modems have been accepted, the windows program "Hyper Terminal" (Setting COMx, 57600 Baud, 8N1) may be activated by entering the command "AT&V". The settings are not displayed because the echo has been switched off.

Attention: Only the setting 57600 Bd, 8N1 may be used. Other settings are automatically detected and registered by the modem which will later lead to a malfunction.





#### Defining the modem connection in DIGSI 4

DIGSI Manager - Region	n London			· · · · · · · · · · · · · · · · · · ·	
File Edit Insert Device Vie	ew Options Window Help				
<u> </u>	n= n= n= n= n= n= n= n= n= n= n= n= n= n	r>	· V 580 K		
Region London C:\S	iemens\Digsi4\D4proj\Reg	ion_L			
Region London     Substation East     Poeder 1     Poeder 2     Poeder 3	Feeder 1	Feeder 2	Feeder 3		
Substation West	Device catalog		-		
i∃ ⊡ Feeder 2 i∃ ⊡ Feeder 3	Cut Copy	Ctrl+X Ctrl+C			
	Paste	Ctrl+V	_		
	Delete	Del			
<u> </u>	Insert New Object		SIPROTEC device		
	Configure DOSDIGSI Configure DIGSI 4 Folder Device -> DIGSI (Plug & Play). Import Device Update process bus data		Existing V3/V2 device Modem Connection IRC combination Channel switch Existing V3 system IEC61850 station Other IEC61850 communicator		
	Object Properties	Alt+Return			
Inserts Modem Connection at the	e cursor position.				1.

For the substation e.g. "**Substation West**", a modem connection must be established. This defines which modems with corresponding settings and assigned telephone numbers are used for establishing the connection. To do this, open the dialog box with a click on the right mouse button. With "**Insert new object**", a "modem connection" can be entered into the feeder file.

In the pull-down window the "Local modem" and the "Remote modem" may be selected from the list of the modems already created in DIGSI 4.

Properties - Modem Con	inection	×
Modem Assignment		
Local modem:	Office Modem	•
	Propertie <u>s</u>	
<u>R</u> emote modem:	Substation West	
	Properti <u>e</u> s	
ок		Cancel Help

Save with "OK".



📓 DIGSI Manager - Region Long	ion				
File Edit Insert Device View Op	otions Window I	Help			
□ 🛩 🔏 🛍 🛍 🖫 🗄		No Filter >	• 🏏 🖷 🗖		
Region London C:\Siemer	ns\Digsi4\D4pro	oj\Region_L			
Begion London     Substation East     Eeder 1	Eeder 1	🧰 Feeder 2	🧰 Feeder 3	Modem Connection Open Object	Ctrl+Alt+O
				Cut Copy Paste	Ctrl+X Ctrl+C
E Substation West				Delete	Del
⊡- 🧰 Feeder 3				Object Properties.	Alt+Return
Displays properties of the selected object	t for editing.				

The "modem connection" is now displayed in the substation folder "Substation West". Under (right mouse click) "Object Properties" the dialog box is again opened.

	Properties - Modem Connecti	ол	$\mathbf{\times}$
	General Modem Assignment		
Under " <b>Properties</b> " the modem settings and assigned " <b>Addresses</b> " (Telephone numbers) may be checked or changed	Local modem:	Office Modem	]
Note: If the settings of the modems are changed, the settings of the system modem driver must be changed correspondingly.	<u>R</u> emote modem:	Substation West Propertigs	j
	ОК	CancelHelp	

All settings in DIGSI 4 are now complete and the office modem can be connected to the operating PC via a standard modem cable which is usually supplied in the scope of delivery.

The substation modem is connected with the special cable 7XV5820-0AA10 to the RS233.interface of a star coupler 7XV5300, 7XV5450, 7XV5550 or a RS232-FO converter. The cable has a symmetrical construction and may be used in any direction.



#### Establishing the modem connection

The modem connection may be established by double clicking on "modem connection" and subsequent selection of the device, or directly from the selected protection device.

The office modem is always initialised during the dial-up procedure, and then the assigned telephone number of the substation modem is dialled.

DIGSI Manager - Region Lo	ondon		
File Edit Insert Device View	Options Window Help		
D 🗃 🔏 🛍 🖆 🔚	Keine Kei		
Region London C:\Siem	nens\Digsi4\D4proj\Region_L		
	👔 75J631 V4.2 🏼 👔 75J633 V4.6	5	
Feeder 1	Open device	×	
teeder 2 	Connection type	Connection properties	
	C Offline	Modem connection:	
	C Direct	Region London / Substation West / Modem Connection	
	C USB	Device interface: Back	
	Modem connection	Use channel switch	
	C PROFIBUS FMS		
	C Ethernet		
		Cancel Help	
Press E1 to get Help			

After double clicking on the device, a dialog box is opened.

Under "Connection type", "modem connection" is selected.

DIGSI 4 provides the **"modem connection"** of the closest modem connection in the project, i.e. the one that is first in line above the device in the storage path. Under **"Device interface"** the corresponding device interface, in this case the **"System-interface"** is selected.

Confirm with "OK".

In the following window the "**Number to dial**" is displayed and can again be checked.

"With remote modem ring back" is only checked if operation is done with automatic call-back.

Number to dial:	0017145	56543
<u>пк</u> [	Cancel	Helr

Establish Modem Connection

The connection set-up is started with "OK".

Note: If the telephone number or pre-fix is incorrect, please check the entries in the telephone directory. All numbers must be entered without leading zeroes.

If these are not shown correctly this may be corrected under "Change location".





#### Defining the location

In the window "**Dialing Rules**" new locations may be established or changes may be made to existing ones.

It is an especially useful feature that more than one location may be defined, if a notebook is to be operated at various telephone connections (at home, at the office or hotel).

In the window "Edit Location" the location properties may be defined.

Under "**Phone number will be dialed as**": the set telephone number is displayed.

Close with "OK" and the dial-up procedure is started.

#### **Report-Window**

The dial-up procedure may be monitored in the **"Report-Window**".

If the modem connection has been established (here with 57600 Bits/s at the PC-interface) the connection to the protection device is made automatically.

Good luck!

Messages	Date	Time	<u><u>C</u>lose</u>
Connected to local modem.	30.05.2007	09:25:34	Export
Connecting to remote modem.	30.05.2007	09:25:34	
$igodoldsymbol{0}$ Connection to remote modem is 57600 bits per second.	30.05.2007	09:26:00	Delet
			Delete
			Delete
			Print.

hone and Modem Options	? 🛛
Dialing Rules	
The list below displays the location from which you a	e locations you have specified. Select the re dialing.
Locations:	Area Code
O Home without 0	20
O Office with 0	20
New Phone number will be dialed as:	v <u>E</u> dit <u>D</u> elete
0 0 171 4556543	

Edit Location	? 🗙
General Area Code Rules Calling Card	
Location name: Office with 0	
Specify the location from which you will be dialing.	
Country/region:	Area <u>c</u> ode:
United Kingdom 🗸	20
Dialing rules When dialing from this location, use the following rules: To access an outside line for local calls, dial: To access an outside line for long-distance calls, dial: Use this camer code to make long-distance calls: Use this camer code to make international calls:	
To disable call <u>w</u> aiting, dial:	~
Dial using:	
Phone number will be dialed as: 0 0 171 4556543	
OK Cancel	Apply

