

## Central Operation of SIPROTEC 3 and 4 with DIGSI 4

19,2 kBaud / 8N1

### Introduction

Hereafter follows a guide for the setting-up of a SIPROTEC 3 and 4 substation data management structure with DIGSI 4 (from version 4.40) with a number of bays and/or devices of the same type, with the goal of central operation via star coupler or eventual remote operation via modems.

As shown in the application example „APPL\_E\_DIG4\_SIP3-4\_MS\_FO\_RS485\_CENTRAL.PDF“, the devices may be connected according to security and topology requirements either via fibre optic or RS485 bus. As most of the V3-devices have a maximum Baud rate of 19,2kBaud, this Baud rate and the standard data frame 8N1 should be used for mixed applications (SIPROTEC 3 and 4).

**Note:** 7SD51 and 7SD600 can and should only be operated at 9600 Baud. The Baud rate should in this case be set to 9600 Baud on all the devices and in DIGSI 4. This also applies to SIPROTEC 3 devices without message gap tolerance which are remote controlled via modems. Alternatively operation via an active mini star coupler is recommended to also ensure convenient operation of the SIPROTEC 4 devices.

For this purpose the DIGSI 4 manager on a particular PC must be used to set up the SIPROTEC 4 protection devices. During this process a unique VD address is assigned to each V4 device, while an unused device address is assigned to the each V3 device by DIGSI 4. If the devices are to be operated by a different PC (e.g. note-book), these original project files with the valid VD or device addresses must be copied onto this PC.

The operation of the devices via the front interface using plug and play is always possible.

### Creating a project and substation

A new project and a new folder for the substation e.g. substation east is generated in the DIGSI manager.

### Creating Master Bay/Master Device

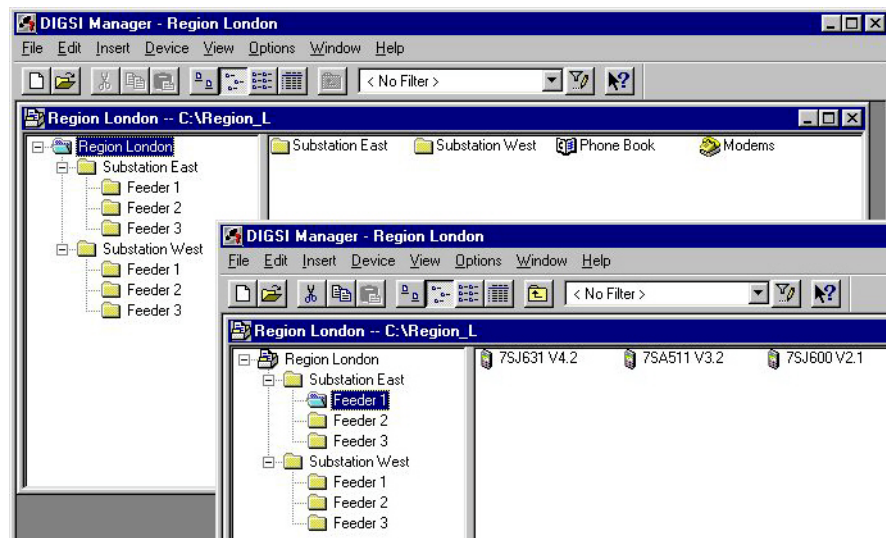
A new folder in the substation folder is created e.g. “Feeder1”. This serves as master bay into which the devices from the device catalogue are inserted.

### Defining a new address range

If the substation path (e.g. Feeder East) is clicked with the right mouse button, a “new address area for device address (V3) or IEC system port address (V4)” for this station can be selected under “Object Properties”, “Address Area”.

If more than one substation is part of the same project, the complete address range, from 1-254, can be used in each substation. Otherwise the range is distributed across the entire project.

An unused device address up to 254 is then automatically assigned for the SIPROTEC 3 devices. When creating a SIPROTEC 4 device, the next unused IEC address for the system interface (if available) is assigned and entered. This does **not** apply to the service interface, i.e. this address must subsequently be changed in the device settings.



## Common Device Settings

Once the first master bay and master devices have been inserted with the DIGSI 4 manager, all the common settings such as power system data, device configuration, matrix I/O as well as the interface parameters can be applied as follows hereunder.

### Setting of the SIPROTEC 3 Device System Interface

The system interface on the rear of the devices is used for central operation of the SIPROTEC 3 devices with DIGSI 4. This system interface may have a RS232 or fibre optic construction. As the RS232 interface is only suitable for point to point connection, the fibre optic interface connected via a star coupler is to be preferred.

If the protection device only has a RS232 system interface, a fibre optic/RS232 converter e.g. 7XV5652 can be inserted between the star coupler and the device. If the system interface is otherwise used or not available, the operation can also be implemented via the front interface, using a plug-in converter, e.g. 7XV5101-0A with angle plug 7XV5101-8x.

The configuration of these interfaces is done with the DIGSI 4 operating programme. Open the protection device with „**Online – direct - front**“ and click on „**Parameter**“ and „**Configuration**“ in the explorer window. Subsequently select „**PC and System Interfaces**“ and enter the following settings in the dialog box.

Address	Function	Value
7208	Function type in accordance with VDEW/ZVE...	128
7211	Data format for PC-interface	DIGSI V3
7214	Transmission gaps for PC-interface	0.0 s
7215	Transmission baud rate for PC-interface	9600 Baud
7216	Parity and stop-bits for PC-interface	DIGSI V3
7221	Data format for system-interface	DIGSI V3
7222	Measurement format for system-interface	VDEW compatible
7224	Transmission gaps for system-interface	1.0 s
7225	Transmission baud rate for system-interface	19200 Baud
7226	Parity and stop-bits for system-interface	No parity, 1 stopbit
7227	Online-switch VDEW-DIGSI enabled	no
7235	Parameterizing via system-interface	no

### Scope of Functions for the System Interface

This setting must be changed from „VDEW-compatible“ to „**DIGSI V3**“.

### Baud rate and frame format of the System Interface

The Baud rate is set to „**19200 Baud**“, and the frame format is set to „**no parity 1 stopbit**“ (8N1). The advantage of this setting is that the substation can be extended to facilitate remote operation via modems without any additional setting changes.

The front interface may remain unchanged with the pre-settings, which simplify direct operation in situ. If central operation has to take place via the front interface, then this interface must also be changed with the corresponding settings.

### Message gaps on the system interface

If the setting „Transmission gaps for system-interface“ is available, it is set to **1,0 s** to ensure that the device is “gap tolerant” for remote communication. The gap setting corresponds to the maximum permissible duration of a transmission gap inside a transmitted telegram. This setting is only significant if the device communicates via modem. Message gaps occur due to data compression, error correction and large baud rate variants between terminal device and communication equipment, when modems are used.

**Note:** The baud rate of the device interfaces must be equal to or smaller than the baud rate of the remote interface to avoid permanent gaps following each byte.

## Changing settings via the device interface

If settings changes must also be possible via the system interface, this parameter must be set to “Yes”.

## Saving the SIPROTEC 3 Device Settings

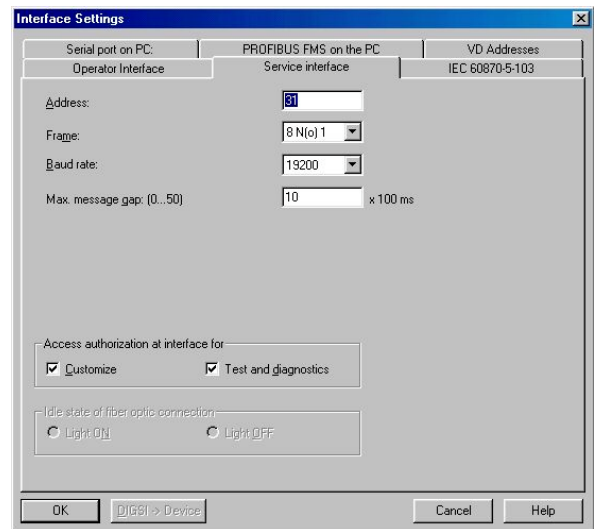
After „Close“ the setting window, the settings are saved in the protection device as well as DIGSI 4.

## Viewing Device Settings

By means of the navigation keys or direct entry of the setting parameter address (e.g. „DA“ „7200“ „E“), all settings can be viewed or changed.

## Service Interface Settings in the SIPROTEC 4 Device

For central operation of the SIPROTEC 4 devices by means of DIGSI, the service interface on the rear of the devices is used. This may be a RS232, RS485 or fibre optic interface. These interfaces are identical except for their electrical (physical) properties. All versions function with the same DIGSI 4 protocol, i.e. the setting page with the service interface parameters is nearly the same for all SIPROTEC 4 devices.



## Baud rate and Data Frame

The baud rate is set to „**19200 Baud**“, and the frame to „**8 N(o) 1**“ (8N1), i.e. all devices from the operating PC to the protection device are set with these parameters. If other settings e.g. 57600 Baud 8E1 are required, all the settings throughout must be changed.

## Service Interface Address

Within a substation structure, the service interface of each SIPROTEC 4 device must be assigned a unique address. A total of 254 addresses per substation are available. The service interface address in DIGSI 4 and in the device must correspond.

**Note:** *Newly generated devices are always assigned with the address 1. When devices are copied, the address is also copied. There is no automatic check to avoid multiple use of the same address .*

## Message gaps

The maximum message gap of the device is set to 1,0 s (also see sending a „Ping“).

The gap setting corresponds to the maximum permissible duration of a transmission gap inside a transmitted telegram. If a personal computer is directly connected to the device, the setting for “max. message gap” can be 0 s. This setting is only significant if the device communicates via modem. Message gaps occur due to data compression, error correction and large baud rate variants between terminal device and communication equipment, when modems are used.

On typical communication links with modems a setting of 1,0 s is sufficient.

**Note:** *The baud rates of the device interfaces should be equal to or smaller than the baud rate of the transmission link to avoid permanent gaps following each byte.*

## ***Sending a „Ping“***

If the parameter “maximum message gap” in the SIPROTEC 4 devices up to version 4.1x is set with a value greater than 0s, the device will send a “ping”, i.e. a message „ATE0Q1“, at the baud rate set inside the protection device, every 11-16 seconds (timing generated randomly). From version 4.2x onwards, this “ping” is only sent for maximum message gaps of 2.1 s and greater, which allows a maximum message gap setting of 2.0s without “ping”. Before sending a “ping” the protection device checks, by “listening” on the bus, whether data traffic is present in the system, and only transmits a “ping” in the system when no data traffic is present.

The message „ATE0Q1“ synchronises the connected modem to the baud rate set in the protection device, and disables the echo-function in the modem.

**Note:** Some modems cancel the connection immediately if a “ping” is received during establishment of the connection. In the ke-modems for example, this is prevented with the parameter „ATS20=0“. As problems in conjunction with the “ping” can also be encountered with other modem types, the gap tolerance of the devices should be set such that no “ping” is transmitted, and that the baud rate of the substation modem is set at a fixed value.

## ***Copying of Master and/or Master device***

Once the settings in the master devices have been done, the entire master bay or each master device individually, is copied in the substation folder as often as required, by using the functions “copy and paste” or “drag and drop”. During copying all the settings (also the interface address) of the master device are maintained. DIGSI 4 however allocates a new VD address for each new device.

## ***VD-Address***

With DIGSI 4 the VD address can be viewed under the **Object Properties** (DIGSI manager; edit; object properties; FMS/IEC setting). It can however not be changed.

## ***Initialising SIPROTEC 4 devices***

Before initialising the devices, the interface addresses of the duplicated devices must be changed. Subsequently each device in turn is initialised with a DIGSI cable 7XV5100-4 connected to the front interface. During initialisation all settings, as well as the VD address, are transferred.

## ***Viewing and Changing Device Settings***

Via the keypad and display of the device, the most important interface parameters can be viewed and changed

SERVICE PORT	02 / 04
Phys. Addr.	31
Baudrate	19200 Baud
Parity	8N1
Gaps	1.0s

## Testing Central Control

Commissioning should be co-ordinated and done in small steps. In distributed topologies, it is recommended to commission individual branches (e.g. cascaded star coupler or several RS485 buses) in turn.

If all devices are properly connected, these can be sequentially operated with DIGSI 4 via the rear interface. For this purpose select "**Open Device**" in the DIGSI 4 (refer to screen shot on the right). In this example, the connection with the protection device is established via the COM 1 interface of the operating PC to the "**rear**" "Device interface" of the selected SIPROTEC device. Thereby the communication parameters of the service interface, set with DIGSI 4, are automatically used.

ATTENTION! For the protection devices 7SJ600/602, 7RW600 and 7SD600 select "**front**" for "Device interface".



## Fault diagnosis

Experience has shown that if fault free operation of the device is not possible, this is often only due to small errors that have crept in and that prevent correct operation. Therefore use a systematic approach in the fault diagnosis.

### Method

- Check the settings with DIGSI 4.
- Check device settings via the front display.
- Check the communication components.
- Check all connections of the communication equipment.
- Test communication with the first protection device (all other devices are disconnected).
- Sequentially connect and test the other devices/branches.

### Settings DIGSI 4 / Protection Devices

- Was the project generated on a single PC i.e. no duplication of VD addresses?
- Do the service interfaces in DIGSI 4 all have unique IEC addresses?
- Do the baud rate and data frame of all service interfaces in DIGSI 4 have the same setting?
- Were all the protection devices initialised with these settings?
- Are the jumper settings on all service interfaces (RS232/RS485) in the protection devices correct?

### Communication components

- Are the settings of the used converters correct e.g. data frame, Idle state of FO connection etc.
- Have the prescribed electrical communication cables with correct pin allocation been used?
- Have plastic FO connectors longer than 3.5 m been used?
- Do the implemented FO cables match the wave length 820nm viz. 1300nm of the converter?
- Are the FSMA-plugs of the FO cables fitted properly and not over tightened?
- Have all the FO connectors been crossed over (transmitter to receiver and vice versa)?

Have fun!