Addressing Remote Modules

Introduction

If inputs or outputs are located at a distance from a Jetter PROCESS-PLC, they can reside on special remote modules. These remote modules are connected to the PROCESS-PLC via the JetWay.
This application note describes how to select and program remote modules.

Comparison of Remote D32 and NANO with Expansion Modules

The following modules can be used as remote modules:

- remote D32 or remote E16 as well as
- NANO-A, B or C with expansion modules.

The table below illustrates the advantages and disadvantages of the two module types:

Function	Remote D32	NANO with expansion modules
Number of digital I/Os	Fixed	Variable
Function	Only digital I/Os	Functions of all expansion modules
Register overlay	Simple	Complex
Terminals	Outputs: single terminals; Inputs: three-level terminal blocks	All I/Os on single terminals, exception: N-IO16
Setting the network address	Switch	A program is necessary
Size with comparable number of I/Os	Flat	Thinner, not as high
Price with comparable number of I/Os	Expensive	Less expensive

IO: digital inputs and outputs

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Which Remote Module for Which Application?

Remote module required with digital inputs and outputs only

The remote D32 provides 16 digital inputs and 16 digital outputs. If you only need digital inputs, you can use the remote E16. This module is not described in detail here since it generally behaves like the remote D32 and is also programmed like the remote D32.

Using a NANO with expansion modules gives you more flexibility with respect to the number of digital inputs and outputs per remote module: with one NANO-A, a minimum number of eight digital inputs and six digital outputs is possible.
Please take into account that the NANO-A only has six digital outputs. Thus, only 14 digital outputs but 16 digital inputs would be available when using a NANO-A, N-ID8, and N-OD8. This combination resembles the remote D32-module most.
A NANO-B or C is only used when more than 62 digital inputs and outputs are required (NANO-A and six expansion modules). With a NANO-B or C, up to 136 digital inputs and outputs can be realized (NANO-B or C plus 15 expansion modules).

Remote scan function in conjunction with PASE-E and DELTA

This section describes the use of remote scan. Remote scan offers the possibility to map all digital inputs and ouputs arranged on the remote modules to input and output numbers on the CPU. This means that this function allows to directly access digital inputs and outputs of remote modules by means of input and output commands.
A max. number of 32 digital inputs and outputs can be queried per module. Remote scan is only available for the two PROCESS-PLC systems PASE-E and DELTA.

Remote module required with added functions

The remote D32 only provides digital inputs and outputs. If a NANO is used as remote module, all available expansion modules can be connected to it.

- N-OD8 — 8 digital outputs
- N-ID8 — 8 digital inputs
- N-IO16 — 8 digital outputs, 8 digital inputs
- N-IA4 — 4 analog inputs, ±10 V (12 bits) or 4 ... 20 mA (11 bits)
- N-OA2 / N-OA4 — 2 or 4 analog outputs, ±10 V (12 bits)
- N-CNT 1 — 1 single-channel counter (10 kHz), 1 dual-channel counter (500 kHz), SSI encoder
- N-PRN 1 — 1 parallel Centronics printer port
- N-SER 1 — 1 user-programmable interface (PRIM)
- FESTO CP-modules — 1 valve terminal, or 1 output module, or 1 input module

In addition, when using a NANO-B or C:

- N-SV1 — 1 axis module to connect a servo amplifier
- CAN-DIMA — 1 digital servo controller with amplifier
- N-SM2 — Axis module for 2 stepper motor axes
- N-SM1D — Axis module for 1 stepper motor axis with integrated amplifier
- N-PID 1 — 4 PID controllers
- N-Profi1 — 1 Profibus DP slave, 12 MBaud

Display units and user interfaces can also be connected to the NANO used as remote module. Besides, it is possible to use the registers of this NANO as additional memory.

Note

About five milliseconds are to be taken into account per register to be transmitted from the master via the JetWay to the remote module. If the number of registers to be transmitted becomes too high due to the great number of digital inputs and outputs or due to the high complexity (axes, connection to profibus, …), then performance losses during the communication with this remote module might occur.

Error Diagnosis

Remote D32

The remote D32 indicates an error visually by a blinking red LED (ERR-LED). The error condition can then be queried in the status register (register zero) of the module.
The remote D32 makes a distinction between a network error (problems with the JetWay communication) and an overloaded digital output.

NANO

The NANO also indicates the error condition visually by the ERR-LED.
Errors at an overloaded digital output are not indicated visually but can be queried in register 2027. Each bit in this register is assigned to a module:

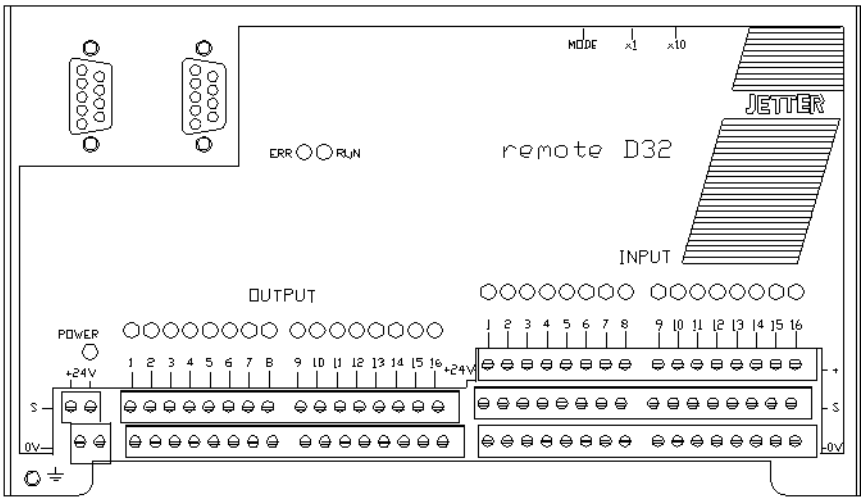
Bit 0: 1 ➔ one or more digital outputs on the NANO are or were overloaded
Bit 1: 1 ➔ one or more digital outputs on the first expansion module are or were overloaded
Bit 2: 1 ➔ one or more digital outputs on the second expansion module are or were overloaded
Bit 3: 1 ➔ one or more digital outputs on the third expansion module are or were overloaded
....

The register must be reset to zero again by the SYMPAS program.

Timeout errors caused by accessing non-existing module registers, for example, are indicated as usual by register 2008. For more details, please refer to the NANO manual.

Register Overlay

RemoteD32



All 16 digital inputs of the remote D32 are overlaid on register 10 of the module.

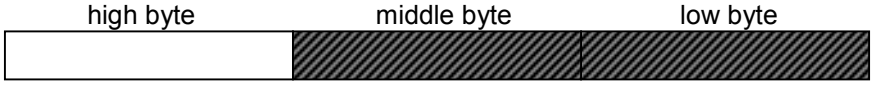
Bit # of register 10	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Input #	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

Likewise, all 16 digital outputs of the remote D32 are overlaid on register 14 of the module.

Bit # of register 14	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Output #	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

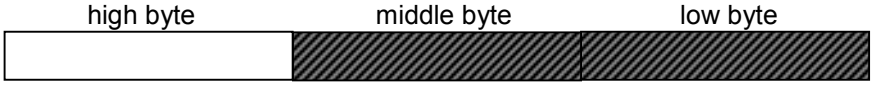
Depicted in another way:

Assignment of register 10 (inputs):



assigned unassigned

Assignment of register 14 (outputs):



assigned unassigned

This means that by reading register 10, all 16 digital inputs of the remote module can be read by accessing **only one register**. By writing register 14, all 16 digital inputs of the remote module can be influenced by accessing **only one register**.

NANO

The similar procedure applies to the NANO and its expansion modules. To being able to make a direct comparison with the remote D32, we now take the combination as example that resembles the remote D32 most: NANO-A with N-ID8 and N-OD8

For the inputs, the register overlay looks as follows:

Bit number of register 2400	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Input #	208	207	206	205	204	203	202	201	108	107	106	105	104	103	102	101

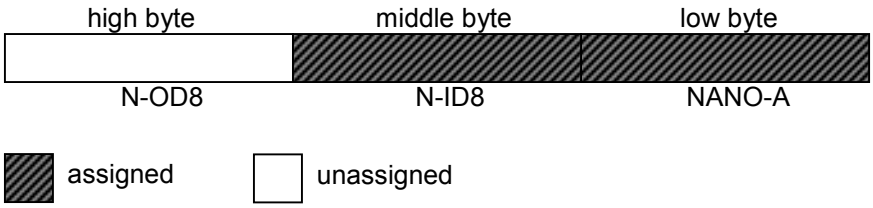
For the outputs, the register overlay looks as follows:

Bit number of register 2500	23	22	21	20	19	18	17	16	7	6	5	4	3	2	1	0
Output #	308	307	306	305	304	303	302	301	n.a.	n.a.	106	105	104	103	102	101

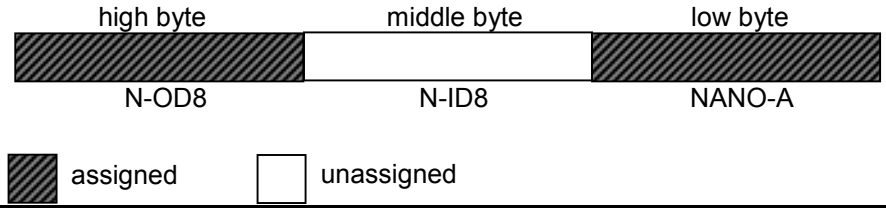
n.a. not assigned

Depicted in another way:

Assignment of register 2400 (inputs):



Assignment of register 2500 (outputs):

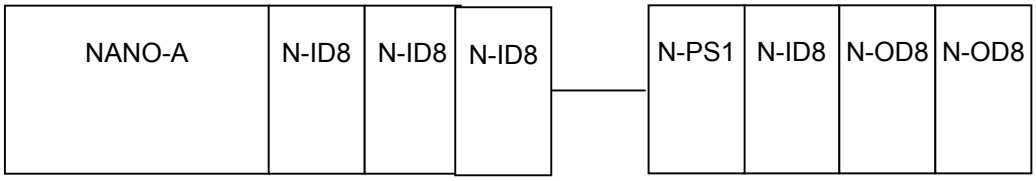


Unlike the remote D32, the two assigned bytes are not located next to the other in the combination NANO-A with N-ID8 and N-OD8. Instead, an unassigned byte is located between the two assigned bytes at the outputs. This must be taken into account when addressing the outputs via the overlaid register.

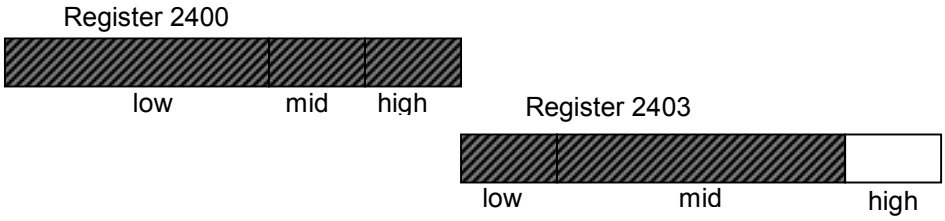
The same as mentioned above applies here as well: by reading register 2400, all 16 digital inputs of the remote module (combination NANO-A with N-ID8 and N-OD8) can be read by accessing **only one register**. By writing register 2500, all 16 digital inputs of the remote module can be influenced by accessing **only one register**.

When a NANO is used as remote module, it is practical to first arrange all digital input modules and then all digital output modules (or vice versa). In this case it is easier to access the digital inputs and outputs via overlaid registers than when the modules are mixed.

Example:

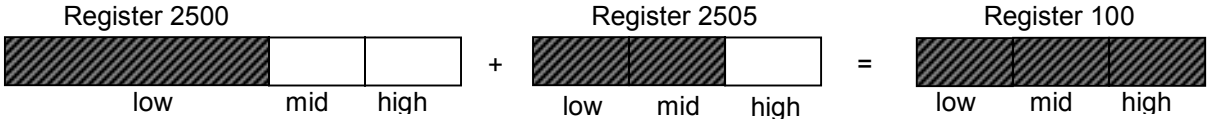


Inputs



Outputs

The digital outputs can be combined to a register by means of a program:

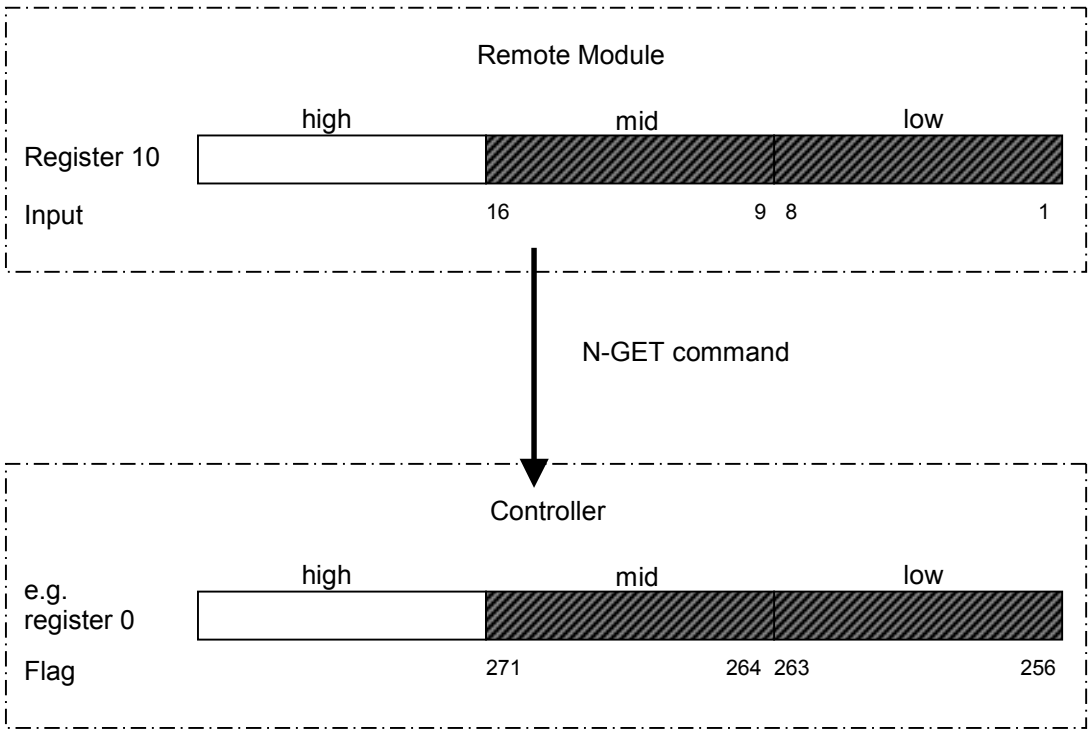


In our example it would be sufficient to only send register 100 to the remote module. All digital outputs are then mapped in this register.

Why overlaid registers?

On the one hand it is possible to access individual digital inputs or outputs, on the other hand the overlaid register can be used. Each JetWay access consumes time. If 16 digital inputs are polled individually, this will take about four milliseconds per access. If the overlaid register is used, 16 digital inputs are available with each JetWay access. If these registers are then placed in a register range of the controller that is overlaid on flags, then the digital inputs can be queried by flags. Since it is not known when a digital input changes at the remote module, the overlaid register must be polled permanently.
The similar applies to the digital outputs of a remote module. In this case we recommend to use a register range that is overlaid on flags. It is only practical to write outputs when their states have changed. Therefore the register overlaid on the flags is only sent to the remote module when its content has changed. This relieves the JetWay considerably. With one write access, 16 digital outputs can be influenced simultaneously.

Example: The 16 digital inputs of the remote D32:



Overlay:

Flag 256 ➔ Input 1 of the remote module
Flag 257 ➔ Input 2 of the remote module
Flag 258 ➔ Input 3 of the remote module
...
Flag 271 ➔ Input 16 of the remote module

Exemplary program for the communication with a remote D32:

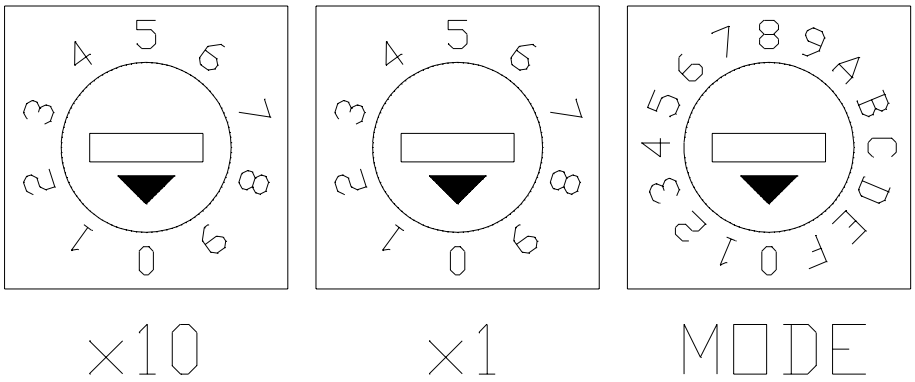
```
0: TASK tJetWay ----------------------------------
1:       REGISTER_LOAD [rsNetworkNo with 1]
2: LABEL lMajorLoop
3:       N-FETCH-REGISTER [from nRemoteModule1 Reg=rmInput, Reg here=rInput]
4:   IF
5:       REG rOutputOld
6:       #
7:       REG rOutputNew
8:     THEN
9:       N-SEND-REGISTER [to nRemoteModule1 from Reg=rOutputNew to Reg=rmOutput]
10:       REGISTER_LOAD [rOutputOld with R(rOutputNew)]
11:     THEN
12:       GOTO lMajorLoop
End of program
```

Line number	Comment
0	All network commands are combined in the JetWay task. No other task comprises JetWay commands. Background: if this is the case, network commands can be made interruptible on some controllers (PASE-E, DELTA). Usually this task has already been completed since the digital inputs have to be polled in any case.
1	In more extensive programs, the network number is set during the initialization phase of the program. No separate task is necessary for this purpose. The present controller becomes the master, therefore node number 1 is assigned to it.
2	End of the initialization phase, beginning of the major loop to be processed cyclically.
3	Polling the digital inputs by means of the overlaid registers (rmInput: 10).
4	Write outputs only when the state has changed.
5	Register 100. This register need not be overlaid on flags.
6	# corresponds to „unequal“
7	The new output state (rm output new) is caused by setting a flag that corresponds to a digital output on a remote module (see above).
8	End of the if condition
9	Sending the digital outputs by means of the overlaid register (rmOutput: 14).
10	Taking over the new status register to the old one.
11	End of the if instruction.
12	Return to the major loop

Setting the Network Address

Remote D32

The remote D32 is provided with two switches to set the network address: switch x1 and x10.



The x1 switch serves to set the units place of the network address, and switch x10 to set the decimal place. Address 1 is reserved for the master and must therefore not be assigned. This leaves addresses 2 … 99 for the addressing of remote D32 modules.
The function of the third switch on the remote D32 (mode) is described in the technical documentation of the device.

NANO

If a NANO is used as remote module, its network address must be written to register 2700. This register looses its value when the device is switched off. When switching on the device, the value of the register is always 2.
If a network is configured that consists of several NANOs as remote module, then a program must run on each controller that sets at least the network address.
Here as well, address 1 may not be assigned since it is reserved for the master. For the NANO, network addresses from 2 … 127 can be assigned.

Register 2700: Network Address	
Function	Comment
Read	Present network address in the JETWay Value after reset: 2
Write	New network address in the JETWay: Value 0: indirect addressing (see register 2707) Value 1: network master Values 2 – 127: possible slave number
Value range	0 – 127