16.4 NC157

16.4.1 General Information

The NC157 axis controller is an active axis module that can be used to control up to eight ACOPOS axes. The number of axes depends on the scan time specified on the NC157 module. The cycle time can be set as a multiple of 400 µs between 2.4 ms and 5.6 ms.

A higher cycle time setting can be necessary depending on the positioning functions used.

Number of Axes	Minimum Cycle Time
1	2.4 ms
2	2.8 ms
3	3.2 ms
4	4.0 ms
5	4.4 ms
6	4.8 ms
7	5.2 ms
8	5.6 ms

Table 384: NC157 minimum cycle time

Positioning Software

The software for axis control is found in the axis controller FlashPROM. The software can be downloaded. Therefore, positioning software can be updated if necessary.

Drive Interface

The NC157 axis controller has a set value generator for each axis which cyclically calculates the set positions. These set positions are transferred to the ACOPOS drives in each NC157 scan step via the CAN network.

Positioning Types

The user has a choice between several types of positioning:

- **Online Positioning**

  Changing the values for a movement (position, speed and acceleration) is possible at any sampling instant.

- **Electronic Gears**

  One or more gear axes have a certain relationship to a reference axis. The gear ratio and the angles of the gear axes to each other can be changed during a movement. The gear ratio or axes coupling (turning gear axes on and off) can be defined when the movement is stopped.

- **Electronic Cam Profile**

  Electronic cam profiles allow a non-linear connection between two drives (coupling functions) to be easily created. Several cam profiles can exist simultaneously on the NC157 and they can be switched when needed. Up and down synchronization is also possible when the reference axis is not stopped. All limits are taken into consideration during this procedure (speed, acceleration).

Additional Applications:

- **Flying Saw**
  - Optimized timing for movements
  - Immediate return when cut is completed
- **Cross Cutter**
  - Optimized movement
  - Print mark control
- **Interpolation**
  - Extensive NC interpreter
  - Linear, circular and helix interpolation with tangential axis
  - Dynamic "Look Ahead"
  - Gantry axes
  - Real-time intervention using virtual axes
- **Axis Synchronization**
  - Real-time positioning
  - Varied synchronization conditions
- **Virtual Axes**
  - Virtual master
  - Real-time intervention in active processes (to superimpose real axes)

- **Remote Axes**
  - Distributed axis controller according to machine functions
  - Connected via fieldbus

CNC Functions

Languages

In addition to the standard DIN 66025 syntax, the user is also provided very useful language expansions. Therefore, e.g. statements such as IF, ELSE, WHILE, SWITCH or arithmetic and trigonometric instructions (e.g. +, *, /, sin, cos, arctan) can be used. Up to 1000 R parameters are available as variables.

Interpolation

Straight, circular (helix) with tangential axes, level tool radian correction.

"Look Ahead" Function

A "Look Ahead" function is implemented which is used to make sure that axes limits are not exceeded.

Object-oriented Axis Programming

Tasks can be created quickly and reused using the new type of object-oriented axis programming. Thoroughly tested, high performance tools are used for this purpose.

The success of this new principle has been indicated by solutions in the main areas of automation technology.

Synchronization

If several NC157 axis controllers are used in a system, the sampling instant can be synchronized by linking the "Sync" connections. This guarantees high precision even when coupling gears between different NC157 modules.

Axis Coupling over Multiple Modules

When coupling axes over multiple modules (gears, cams, CNC), the set positions of the master axes are sent to the NC157 modules with the slave axes in an interrupt routine running on the main CPU. The interrupt routine is not allowed to be stopped. These requirements are fulfilled by the following CPUs:

- CP260
- IF260 when it is used as a main CPU

Restrictions

If electronic gears or cam profiles which are coupled between different modules or racks [1] are used in the application, no other interrupt capable modules (e.g. IF050, IF060, IF260 or IP161 as a parallel processor, EX150 and NW150) can be used in combination with the NC157.

16.4.2 Order Data

Model Number	Short Description	Image
	Axis Controller	
3NC157.60-1	2005 positioning module, CAN bus interface for controlling up to 8 axes, 2 trigger inputs, 24 VDC, sink, 4-pin terminal block included in the delivery.	
	Software	
1A3530.01	2005 positioning software, NC157.60-1 standard operating system	
Additional accessories see sections "Accessories" and "Manuals".		

Table 385: NC157 order data

1) Coupling between racks: The data exchange required for axes coupling takes place via the CPU's CAN bus.

16.4.3 Technical Data

Product ID	NC157
General Information	
C-UL-US Listed	Yes
B&R ID Code	$66
Module Type	B&R 2005 system module
Can be Installed on Main Rack Expansion Rack	 Yes No
RAM	2 MB DRAM
System PROM	2 MB FlashPROM
NC157 Axis Coupling over Multiple Modules Supported by	CP260, IF260
Status Display	LEDs
Number of Axes	8
Operating Temperature	0 to 55° C
Power Consumption 5 V 24 V Total	 Max. 6 W --- Max. 6 W
Servo Interface	
Type	CAN
Controller	Controller 82527
Design	9-pin DSUB plug
Electrical Isolation	Yes
Maximum Distance	60 m
Maximum Baud Rate Bus Lengths up to 60 m	 500 kBit/s
Network Capable	Yes
Bus Termination Resistor	External
CAN Node Number	Selection switch
Mechanical Characteristics	
Dimensions	B&R 2005 double-width

Table 386: NC157 technical data

16.4.4 Status LEDs

Image	LED	Description
	ERROR	The ERROR LED blinks in a 500 ms cycle (READY LED goes out). The ERROR LED is constantly lit during a hardware reset.
	READY	The READY LED blinks slowly (once every 2 seconds) if the software module BOOT is not present. The READY LED blinks quickly (5 time per second) if the software module BOOT is present, but the operating system is not present. The READY LED is lit constantly after a successful initialization i.e. the NC157 is ready for operation.
	STATUS	The STATUS LED indicates the individual boot phases.

Table 387: NC157 status LEDs

16.4.5 Operational and Connection Elements

The CAN interface, status LEDs, the terminal block for the trigger supply and synchronization and the terminal block for the triggerinputs can be found behind the module door.

① Interface used to download the BOOT software module

② 4-pin terminal block (trigger supply, connection for synchronization with other NC157 modules)

③ Node number switch

④ CAN interface

⑤ 4-pin terminal block (connection for trigger inputs)

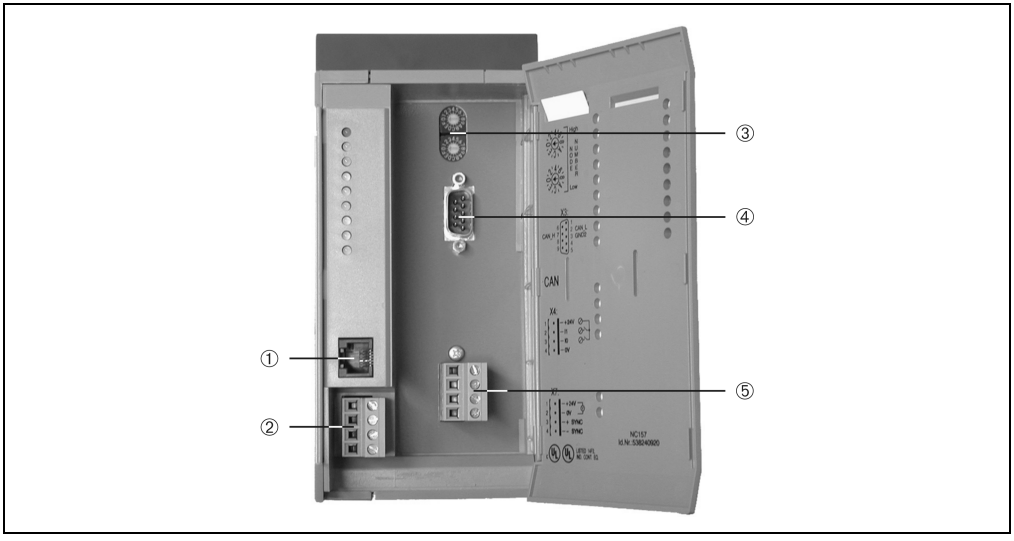


Figure 213: NC157 operational and connection elements

16.4.6 Interface Used to Download the BOOT Software Module

The BOOT software module is required to update the NC157 operating system (operating system update). This module is already installed.

A PC can be connected to the NC157 via this interface using a cable available from B&R (0G2001.00-090). The BOOT (NC157.S1) software module can be downloaded using this connection.

The operating system is updated using the programming device via the CPU's online interface.

Figure 214: NC157 interface used to download the BOOT software module

16.4.7 Trigger Supply / Synchronization

To supply the triggers inputs, + 24 VDC must be applied to this connector. The trigger inputs are connected to the plug described previously (position 5).

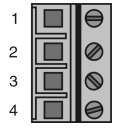
4-pin Terminal Block	Terminal	Assignment	Description
	1	+24 V (Trigger)	Trigger Supply: +24 VDC
	2	COM (Trigger)	Trigger Supply: ⊥
	3	Sync+	Synchronization +
	4	Sync-	Synchronization -

Table 388: NC157 pin assignments for trigger supply /synchronization

16.4.8 CAN Interface

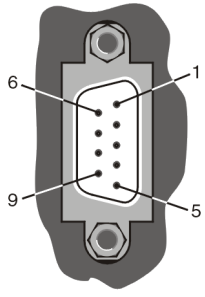
9-pin DSUB plug	Pin	Assignment	Description
	1	NC	Not assigned
	2	CAN_L	CAN Low
	3	CAN_GND	COM
	4	NC	Not assigned
	5	NC	Not assigned
	6	Res.	Reserved
	7	CAN_H	CAN High
	8	NC	Not assigned
	9	NC	Not assigned

Table 389: NC157 CAN interface

16.4.9 Trigger Inputs

Pin Assignments

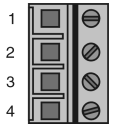
4-pin Terminal Block	Terminal	Assignment	Description
	1	+24 VDC	+24 VDC Output
	2	Trigger 1	Trigger Input 1
	3	Trigger 0	Trigger Input 0
	4	COM (2, 3)	Ground: ⊥

Table 390: NC157 pin assignments for trigger inputs

Connection Example

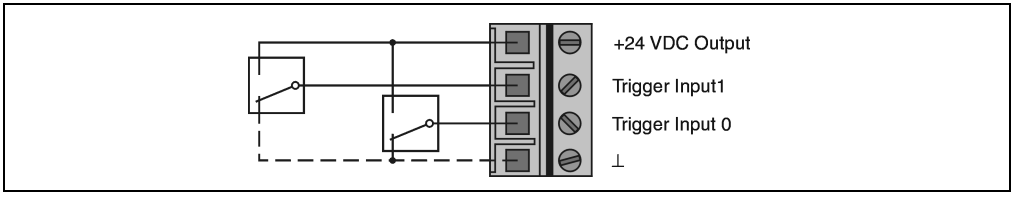


Figure 215: NC157 connection example for trigger inputs