

Variable speed drives for asynchronous motors

Altivar 61

Option: "Controller Inside" programmable card

Presentation

The "Controller Inside" programmable card is used to adapt the variable speed drive to specific applications by integrating control system functions.

Various predefined configurable applications are sold by Schneider Electric and its partners.

The PS 1131 software workshop for PC is used for programming and debugging new applications, quickly and in an open-ended manner (see page 60204/5).

It is not possible to transfer the program from the card to the PC, which enables us to protect our know-how.

A single "Controller Inside" programmable card can be installed in the Altivar 61 drive. It can be combined with another option card (I/O extension or communication). Consult the tables summarizing the possible combinations between drives, options and accessories, see pages 60674/2 to 60674/7.

The "Controller Inside" programmable card has:

- 10 logic inputs, 2 of which can be used for 2 counters or 4 of which can be used for 2 incremental encoders
- 2 analog inputs
- 6 logic outputs
- 2 analog outputs
- A master port for the CANopen machine bus
- A PC port for programming with the PS 1131 software workshop

If the power consumption table does not exceed 250 mA, the "Controller Inside" programmable card can be powered by Altivar 61 drives. Otherwise, an external 24 V $\overline{\text{DC}}$ power supply must be used.

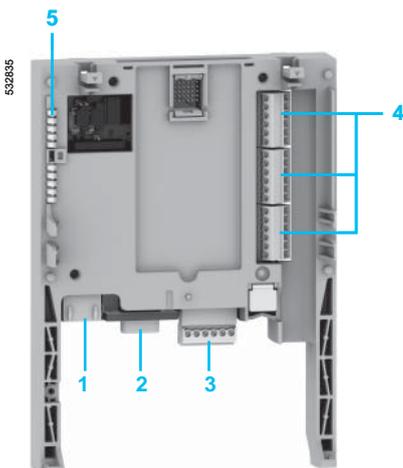
The ATV 61W●●●N4A24 variable speed drives incorporate a 24 V $\overline{\text{DC}}$ power supply and allow an additional consumption of 200 mA.

The "Controller Inside" programmable card can also use:

- The drive I/O
- The I/O extension card I/O
- The encoder interface card points counter
- The drive parameters (speed, current, torque, etc.).

Description

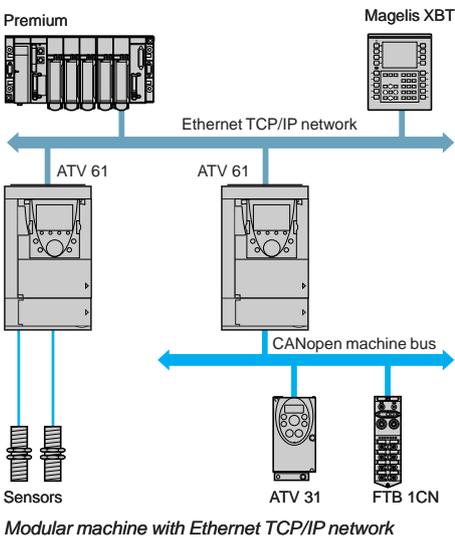
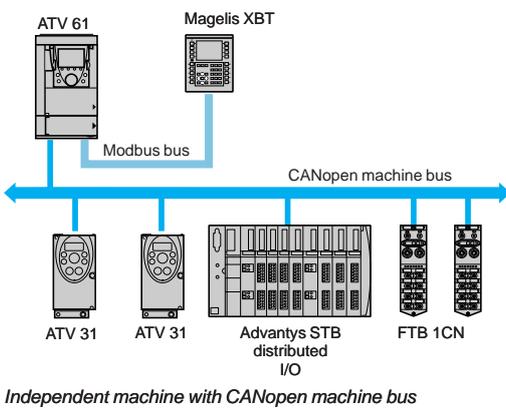
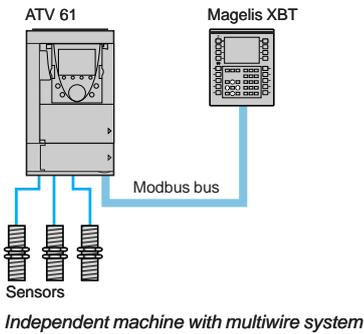
- 1 RJ45 connector for connecting the PS 1131 software workshop via an RS 485 serial link.
Connection to the PC is via a cable and an RS 232/RS 485 connector included in the VW3 A8 106 PowerSuite for PC connection kit.
- 2 9-way male SUB-D connector for connection to the CANopen machine bus.
- 3 Connector with removable screw terminals, 6 contacts at intervals of 3.81 for the 24 V $\overline{\text{DC}}$ power supply and 4 logic inputs.
- 4 3 connectors with removable screw terminals, 6 contacts at intervals of 3.81 for 6 logic inputs, 6 logic outputs, 2 analog inputs, 2 analog outputs and 2 commons.
- 5 5 LEDs, comprising:
 - 1 to indicate the presence of the 24 V $\overline{\text{DC}}$ power supply
 - 1 to indicate a program execution fault
 - 2 to indicate the CANopen machine bus communication status
 - 1 controlled by the application program



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Dialogue

Human-machine dialogue with the application programmed in the "Controller Inside" programmable card is possible using:

- The Altivar 61 graphic display terminal
- A Magelis industrial HMI terminal connected to the drive Modbus port
- A Magelis industrial HMI terminal connected to the Ethernet TCP/IP network (if the drive is equipped with an Ethernet TCP/IP communication card)

A graphic terminal menu is dedicated to the "Controller Inside" programmable card. This menu can be customized by the card program according to the application.

Any industrial HMI terminal which supports the Modbus protocol can be used to display and modify the "Controller Inside" programmable card parameters. The Modbus server provides access to 2 Kwords (% MW, etc) in the card.

Master CANopen communication

The master CANopen port on the "Controller Inside" programmable card can be used to extend the I/O capacity and to control other CANopen slave devices.

Communication with a PLC

The Altivar 61 drive equipped with a "Controller Inside" programmable card fits easily into complex architectures.

Regardless of which bus, network or serial link is being used (Ethernet TCP/IP, Modbus/Uni-Telway, FIPIO, Modbus Plus, Profibus DP, INTERBUS, etc.), the PLC can communicate with the "Controller Inside" programmable card and the drive. The periodic variables can still be configured as required.

Clock

A clock backed up by a lithium battery makes it possible to have a log of events that have occurred. When the "Controller Inside" programmable card is installed in the drive, the drive faults are automatically time and date-stamped without special programming.

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Electrical characteristics			
Power supply	Voltage	V	24 V \pm (min. 19, max. 30)
Power consumption	Maximum	A	2
	Current		
	No-load	mA	80
	Per logic output	mA	200 maximum (1)
Analog inputs	AI51, AI52		2 current analog inputs 0°20 mA, impedance 250 Ω Resolution: 10 bits Accuracy: \pm 1% for a temperature variation of 60°C Linearity: \pm 0.2% of the maximum value Common point for all the card I/O (2)
Analog outputs	AO51, AO52		2 current analog outputs 0°20 mA, impedance 500 Ω Resolution: 10 bits Accuracy: \pm 1% for a temperature variation of 60°C Linearity: \pm 0.2% of the maximum value Common point for all the card I/O (2)
Logic inputs	LI51...LI60		Ten 24 V \pm logic inputs, compatible with level 1 PLC, IEC 65A-68 standard, 2 of which can be used for 2 counters or 4 of which can be used for 2 incremental encoders Impedance: 4.4 k Ω Maximum voltage: 30 V \pm Switching thresholds: State 0 if \leq 5 V or logic input not wired State 1 if \geq 11 V
Logic outputs	LO51...LO56		Six 24 V \pm logic outputs, positive logic open collector type (source), compatible with level 1 PLC, standard IEC 65A-68 Maximum switching voltage: 30 V Maximum current: 200 mA Common point for all the card I/O (2)
Connection of I/O	Type of contact		Screw, at intervals of 3.81 mm ²
	Maximum wire	mm²	1.5 (AWG 16)
	Tightening torque	Nm	0.25
Lithium battery	Life		8 years approx.

Characteristics of the application program			
Compiled program (saved in "flash" memory)	Maximum size	Kb	320
Data	Maximum size	Kwords	64
	Saved size (NVRAM)	Kwords	4
	Size accessible by Modbus	Kwords	2

Characteristics of the CANopen communication port			
Structure	Connector		One 9-way male SUB-D connector
	Network management		Master
	Transmission speed		Configurable via the program: 50 Kbps, 125 Kbps, 250 Kbps, 500 Kbps or 1 Mbps
	Address (Node ID)		32 slaves maximum
Services	CANopen application layer		DS 301 V5.02
	Functional profile		DSP 405
	PDO		10 receive and transmit PDOs in total for each slave
	SDO		2 client SDOs per slave (1 read and 1 write). Block transfer
	Error check		Node Guarding, producer and consumer Heartbeat
	Other services		Emergency, Boot-up, Sync
Diagnostics	Using LEDs		2 LEDs: "RUN" and "ERROR", conforming to CIA DR303 version 1.0

(1) Above this, use an external 24 V c power supply.

(2) This common point is also the drive 0 V.

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PS 1131 software workshop

The PS 1131 software workshop conforms to international standard IEC 61131-3, and includes all the functions for programming and setting up the "Controller Inside" programmable card.

It includes the configurator for CANopen.

It is designed for Microsoft Windows® 98, Microsoft Windows® NT 5.0, Microsoft Windows® Millennium, Microsoft Windows® 2000 Professional and Microsoft Windows® XP operating systems.

It benefits from the user-friendly interface associated with these operating systems:

- Pop-up menus
- Function blocks
- Online help.

The PS 1131 software workshop is available in both English and German.

The programming and debugging tools are accessible via the application browser.

This provides the user with an overview of the program and rapid access to all the application components:

- Program editor
- Function block editor
- Variables editor
- Animation tables editor
- Runtime screens editor.

Modular structured programming

The PS 1131 software workshop is used to structure an application into function modules consisting of sections (program code), animation tables and runtime screens. Each program section has a name and is programmed in one of the six available languages. To protect know-how or prevent any accidental modification, each section can be write-protected or read/write-protected.

Exporting/importing function modules

It is possible to export all or part of the tree structure in function modules.

Program structure and execution of an application

The program structure is single-task. It consists of several subroutines.

Exchanges with the drive are performed by a function block available in the standard library.

Cycle execution can be either cyclic or periodic. A software watchdog, which can be configured between 100 and 800 ms by the user, monitors the cycle time.

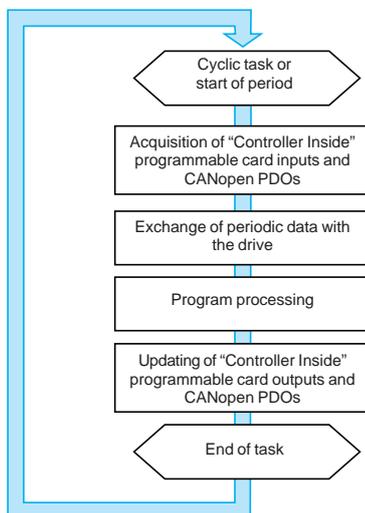
A task can be synchronized with the drive's main task to improve repeat accuracy in motion control applications.

Cyclic execution

Once each cycle ends, execution of a new cycle begins. The cycle execution must last for at least 5 ms.

Periodic execution

The program is executed periodically, and the period can be set by the user between 5 and 100 ms. Cycle execution must last for less than the defined period. Drive response in the event of the cycle time being exceeded can be managed by the program.



Example of cycle execution for the "Controller Inside" programmable card connected on a CANopen machine bus

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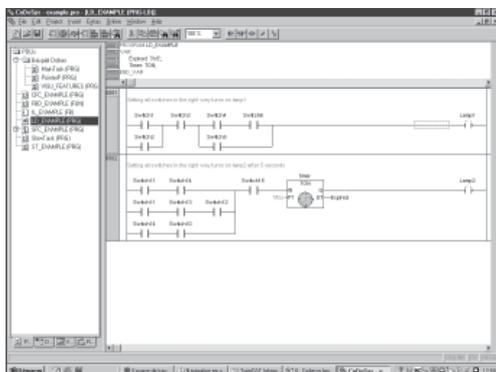
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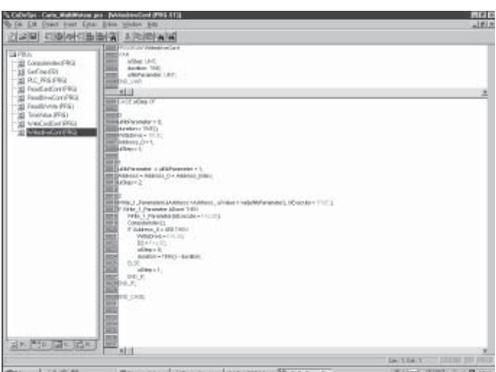
Programming languages

6 programming languages are available:

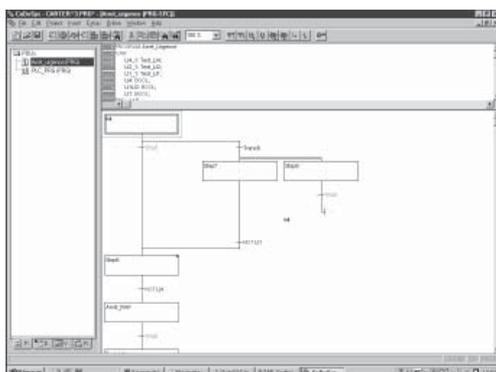
- Ladder language (LD)
- Structured Text language (ST)
- Grafcet language (SFC)
- Instruction List language (IL)
- Function block diagram (FBD)
- Continuous Flow Chart (CFC)



Example of Ladder language programming



Example of Structured Text language programming



Example of Grafcet language programming

Ladder Diagram (LD)

A Ladder language program consists of a set of rungs executed sequentially. A rung consists of several lines.

A line consists of several contacts and a coil.

The language objects can be entered and displayed as symbols or tags as required. The Ladder language editor enables the immediate call of entry help functions such as access to function libraries and access to the variables editor.

Structured Text (ST)

Structured Text language is a sophisticated algorithmic type language which is particularly well-suited to programming complex arithmetical functions, manipulating tables, message handling, etc.

Structured Text language enables direct transcription of an analysis based on a flow chart, and is organized in statements.

Grafcet language (SFC)

Grafcet language is used to describe the sequential part of the control system in a simple, graphic way. It corresponds to the "Sequential Function Chart" (SFC) language described in standard IEC 61131-3.

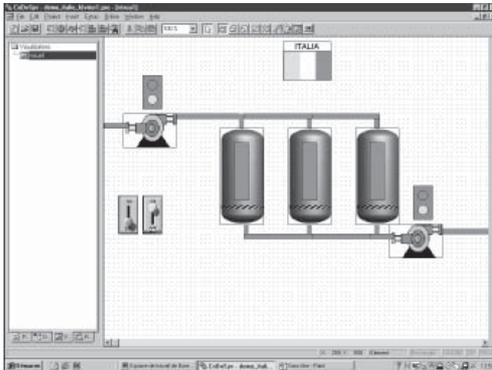
Programs written in Grafcet (SFC) language consist of:

- Macro-steps which are the grouping of a set of steps and transitions
- Steps with which the actions to be performed can be associated
- Transitions with which the conditions are associated (transition conditions)
- Directed links connecting the steps and transitions

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Example of runtime screen

Debugging

The PS 1131 software workshop offers a complete set of tools for debugging the application.

Program execution for debugging

The main debugging functions are:

- Use of breakpoints
- Step-by-step program execution
- Execution of a single cycle
- Direct access to the subroutines that have been called (call stack).

Realtime program animation

The main functions of realtime animation of the program are:

- Animation of part of the program in any language
- Automatic display of a variables window relating to this part of the program

Animation tables

Tables containing variables for the application to be monitored can be created and saved.

In both these tools, in addition to animating the data, it is possible to:

- Modify and force the value of data of any type
- Change the display format (binary, hexadecimal, etc.).

Oscilloscope

The PS 1131 software workshop Oscilloscope function can be used to monitor up to 20 variables in the form of curves.

Runtime screens

A tool integrated in the PS 1131 software workshop can be used to design and use runtime screens for the application:

- Creation of screen backgrounds
- Animation of graphic objects associated with variables
- Display of messages
- ...

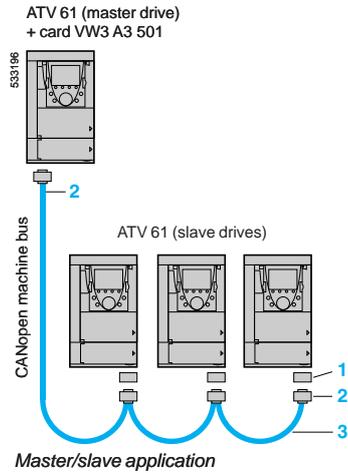
Simulation

The PS 1131 software workshop Simulation function can be used to test the program without having to set up the drive.

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References

Card

Description	Reference	Weight kg
"Controller Inside" programmable card (1) equipped with one 9-way male SUB-D connector	VW3 A3 501	0.320

Connection accessories (2)

Description	No.	Reference	Weight kg
CANopen adapter to be mounted on the RJ45 socket in the drive control terminals. The adaptor provides a 9-way male SUB-D connector conforming to the CANopen standard (CIA DRP 303-1).	1	VW3 CAN A71	—
CANopen connector 9-way female SUB-D with line terminator that can be disabled	2	TSX CAN KCDF 180T	—

Cables (2)

Description	No.	Length (m)	Reference	Weight kg
CANopen cables Standard cable, C€ marking Low smoke emission, halogen-free Flame retardant (IEC 60332-1)	3	50	TSX CAN CA 50	4.930
		100	TSX CAN CA 100	8.800
		300	TSX CAN CA 300	24.560
CANopen cables UL certification, C€ marking Flame retardant (IEC 60332-2)	3	50	TSX CAN CB 50	3.580
		100	TSX CAN CB 100	7.840
		300	TSX CAN CB 300	21.870
CANopen cables Cable for harsh environments (3) or mobile installation, C€ marking Low smoke emission, halogen-free Flame retardant (IEC 60332-1)	3	50	TSX CAN CD 50	3.510
		100	TSX CAN CD 100	7.770
		300	TSX CAN CD 300	21.700

PS 1131 software workshop

Description	Reference	Weight kg
PS 1131 software workshop supplied on CD-ROM	(4)	—
Connection kit for PC serial port including various accessories such as: ■ 1 x 3 m cable with 2 RJ45 connectors ■ 1 RS 232/RS 485 converter with one 9-way female SUB-D connector and 1 RJ45 connector	VW3 A8 106	0.350

(1) The Altivar 61 drive can only take one "Controller Inside" programmable card. Consult the tables summarizing the possible combinations: drives, options and accessories, see pages 60674/2 to 60674/7.

(2) Consult our "Machines and installations with CANopen" catalogue.

(3) Harsh environments:

- resistance to hydrocarbons, industrial oils, detergents, solder splashes
- relative humidity up to 100%
- saline atmosphere
- significant temperature variations
- operating temperature between - 10 °C and + 70 °C.

(4) The product reference is provided during the "Controller Inside" programmable card training course. Please consult your Regional Sales Office.