# Altivar ATV IMC Drive Controller
## Hardware Guide

04/2014

Schneider Electric

The information provided in this documentation contains general descriptions and/or technical characteristics of the performance of the products contained herein. This documentation is not intended as a substitute for and is not to be used for determining suitability or reliability of these products for specific user applications. It is the duty of any such user or integrator to perform the appropriate and complete risk analysis, evaluation and testing of the products with respect to the relevant specific application or use thereof. Neither Schneider Electric nor any of its affiliates or subsidiaries shall be responsible or liable for misuse of the information contained herein. If you have any suggestions for improvements or amendments or have found errors in this publication, please notify us.

No part of this document may be reproduced in any form or by any means, electronic or mechanical, including photocopying, without express written permission of Schneider Electric.

All pertinent state, regional, and local safety regulations must be observed when installing and using this product. For reasons of safety and to help ensure compliance with documented system data, only the manufacturer should perform repairs to components.

When devices are used for applications with technical safety requirements, the relevant instructions must be followed.

Failure to use Schneider Electric software or approved software with our hardware products may result in injury, harm, or improper operating results.

Failure to observe this information can result in injury or equipment damage.

# Table of Contents 📖

# Safety Information

## Important Information

### NOTICE

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

## ⚠ DANGER

**DANGER** indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

## ⚠ WARNING

**WARNING** indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

## ⚠ CAUTION

**CAUTION** indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

## *NOTICE*

*NOTICE* is used to address practices not related to physical injury.

**PLEASE NOTE**

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Schneider Electric for any consequences arising out of the use of this material.

A qualified person is one who has skills and knowledge related to the construction and operation of electrical equipment and its installation, and has received safety training to recognize and avoid the hazards involved.

# About the Book

## At a Glance

### Document Scope

The purpose of this document is to:
- show you how to install and operate your Integrated Machine Controller
- show you how to connect the Altivar ATV IMC Drive Controller to a programming device equipped with SoMachine software
- help you understand how to interface the Altivar ATV IMC Drive Controller with I/O modules and other devices
- help you become familiar with the Altivar ATV IMC Drive Controller features

**NOTE:** Read and understand this document and all related documents (see below) before installing, operating, or maintaining your IMC.

The new users should read through the entire document to understand all features.

### Validity Note

This document has been updated with the release of SoMachine V4.1.

The technical characteristics of the devices described in this document also appear online. To access this information online:

| Step | Action |
|------|--------|
| 1 | Go to the Schneider Electric home page *www.schneider-electric.com*. |
| 2 | In the **Search** box type the reference of a product or the name of a product range.<br>● Do not include blank spaces in the model number/product range.<br>● To get information on grouping similar modules, use asterisks (*). |
| 3 | If you entered a reference, go to the **Product datasheets** search results and click on the reference that interests you.<br>If you entered the name of a product range, go to the **Product Ranges** search results and click on the product range that interests you. |
| 4 | If more than one reference appears in the **Products** search results, click on the reference that interests you. |
| 5 | Depending on the size of your screen, you may need to scroll down to see the data sheet. |
| 6 | To save or print a data sheet as a .pdf file, click **Download XXX product datasheet**. |

The characteristics that are presented in this manual should be the same as those characteristics that appear online. In line with our policy of constant improvement, we may revise content over time to improve clarity and accuracy. If you see a difference between the manual and online information, use the online information as your reference.

## Related Documents

| Title of Documentation | Reference Number |
|---|---|
| ATV IMC Drive Controller Programming Guide | EIO0000000390 (ENG)<br>EIO0000000391 (FRE)<br>EIO0000000392 (GER)<br>EIO0000000393 (SPA)<br>EIO0000000394 (ITA)<br>EIO0000000395 (CHS) |
| Altivar 61 - Installation manual | 1760643 |
| Altivar 61 - Programming manual | 1760649 |
| ATV61 Communication parameters manual | 1760661 |
| Altivar 71 - Installation manual | 1755843 |
| Altivar 71 - Programming manual | 1755855 |
| ATV71 Communication parameters manual | 1755861 |

You can download these technical publications and other technical information from our website at www.schneider-electric.com.

## Product Related Information

> ## ⚠ ⚠ DANGER
>
> **HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**
>
> - Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
> - After disconnecting all power, wait for 15 minutes to allow the DC bus capacitors to discharge in the ATV drives.
> - Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
> - Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
> - Use only the specified voltage when operating this equipment and any associated products.
>
> **Failure to follow these instructions will result in death or serious injury.**

This equipment has been designed to operate outside of any hazardous location. Only install this equipment in zones known to be free of a hazardous atmosphere.

# ⚠ DANGER

**POTENTIAL FOR EXPLOSION**

Install and use this equipment in non-hazardous locations only.

**Failure to follow these instructions will result in death or serious injury.**

# ⚠ WARNING

**LOSS OF CONTROL**

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.
- Observe all accident prevention regulations and local safety guidelines.[1]
- Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems" or their equivalent governing your particular location.

# ⚠ WARNING

**UNINTENDED EQUIPMENT OPERATION**

- Only use software approved by Schneider Electric for use with this equipment.
- Update your application program every time you change the physical hardware configuration.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## Standards and terminology

Technical terms, terminology and the corresponding descriptions in this manual are intended to use the terms or definitions of the pertinent standards.

In the area of drive systems, this includes, but is not limited to, terms such as "safety function", "safe state", "fault", "fault reset", "failure", "error", "error message", "warning", "warning message", etc.

Among others, these standards include:
- IEC 61800: "Adjustable speed electrical power drive systems"
- IEC 61158: "Digital data communications for measurement and control – Fieldbus for use in industrial control systems"
- IEC 61784: "Industrial communication networks – Profiles"
- IEC 61508: "Functional safety of electrical/electronic/programmable electronic safety-related systems"

Also see the glossary at the end of this manual.

# Chapter 1
## About the ATV IMC

### Introduction

This chapter describes the features of the ATV IMC drive controller.

### What Is in This Chapter?

This chapter contains the following topics:

# Altivar ATV IMC Drive Controller

## Introduction

The Altivar ATV IMC Drive Controller (ATV IMC: Altivar Integrated Machine Controller) is an option card which can be installed in the Altivar 61 or the Altivar 71 drive. It can be combined with another option card (I/O extension or communication).

**NOTE:** The ATV IMC is compatible with drives containing a firmware version greater than or equal to V3.3ie43.

Only one Altivar ATV IMC Drive Controller option card can be installed on a drive.

The Altivar ATV IMC Drive Controller is used to adapt the variable speed drive to specific applications by integrating control system functions.

## Key Features

The Altivar ATV IMC Drive Controller supports the following IEC61131-3 programming languages using the SoMachine software:
- IL: Instruction List
- ST: Structured Text
- FBD: Function Block Diagram
- SFC: Sequential Function Chart
- LD: Ladder Diagram

SoMachine software can also be used to program the controller using CFC (Continuous Function Chart) language.

The Altivar ATV IMC Drive Controller can manage up to 9 tasks.

The Altivar ATV IMC Drive Controller includes the following features using the SoMachine software:
- 10 digital inputs (2 inputs can be used for 2 counters or 2 inputs can be used for 2 incremental encoders)
- 2 analog inputs
- 6 digital outputs
- 2 analog outputs
- A master port for the CANopen bus
- A mini-USB B port for programming with SoMachine software
- An Ethernet port to be used for programming with SoMachine software or Modbus TCP communication.

The Altivar ATV IMC Drive Controller can also use:
- The drive I/O
- The I/O extension card (I/O basic and I/O extended)
- The encoder interface card points counter
- The drive parameters (speed, current, torque, etc.)
- The drive remote keypad (as application HMI).

### Compatible Option Cards

The following table provides the references of the ATV 61/71 option cards compatible with the Altivar ATV IMC Drive Controller:

| Reference | Option Card Description |
|---|---|
| VW3A3201 | Logic (digital) I/O card |
| VW3A3202 | Extended I/O card |
| VW3A3303 | Modbus ASCII communication card |
| VW3A3310D | Modbus TCP/IP Daisy-Chain Ethernet card |
| VW3A3304 | Interbus communication card |
| VW3A3316 | Ethernet IP communication card |
| VW3A3309 | DeviceNet communication card |
| VW3A3307 | Profibus DP communication card |
| VW3A3307S371 | Profibus DP V1 communication card |

### Features of the Altivar ATV IMC Drive Controller

The following table lists the features of the Altivar ATV IMC Drive Controller drive controller:

| Reference | Power Supply | Ethernet Interface | CANopen Master | Digital Inputs | Digital Outputs | Analog Inputs | Analog Outputs | Memory Size |
|---|---|---|---|---|---|---|---|---|
| VW3A3521 | 24 Vdc | yes | yes | 10 | 6 | 2 | 2 | 3 MB |

# Physical Description

## Description
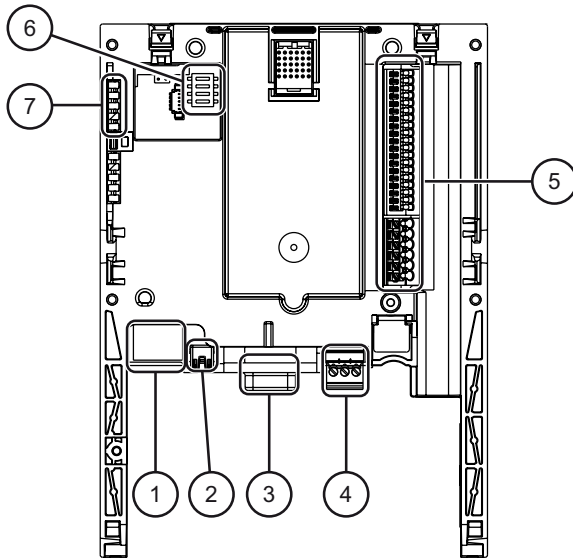


| Legend | |
|---|---|
| 1 | Ethernet port used for programming with SoMachine and for Modbus TCP communication |
| 2 | Mini-USB B port used for programming with SoMachine |
| 3 | 9-pin male SUB-D connector for connection to the CANopen bus |
| 4 | Connector with removable screw terminals, 3 contacts intervals of 3.81 mm (0.15 in.) for the 24 Vdc power supply |
| 5 | 10 logic (digital) inputs, 6 logic (digital) outputs, 2 analog inputs, 2 analog outputs and 5 commons |
| 6 | Block of 4 user configuration switches |
| 7 | 5 LEDs, comprising:<br>● 1 LED G/Y ETH (EtherNet activity)<br>● 1 LED G/R NS (Network Status)<br>● 1 LED G/R MS (Module Status)<br>● 1 LED G/R CAN (CANopen)<br>● 1 LED G/R USER programmable from the customer |

## Controller Features

### Altivar ATV IMC Drive Controller Characteristics

| Power | Voltage | 24 (min. 19, max. 30) | Vdc |
|---|---|---|---|
| Current consumption | Maximum | 2 | A |
| | No-load | 80 | mA |
| | Using logic (digital) output | 200 maximum [1] | mA |
| Internal battery | Life | 12 | Years |

[1]If the logic (digital) output power consumption does not exceed 200 mA, this Altivar ATV IMC Drive Controller can be powered by the drive. Otherwise, an external 24 Vdc power supply must be used and must be able to provide 2 A.

| Compiled program (saved in "flash" memory) | Maximum size | Mbytes | 2.248 |
|---|---|---|---|
| Data | Maximum size | Mbytes | 1 |
| | Saved size (NVRAM) | Kbytes | 96 |
| | Size accessible by Modbus | Word | 60000 |

### Programming

Use the SoMachine software to program the controller.

> ### ⚠ WARNING
>
> **UNINTENDED EQUIPMENT OPERATION**
>
> - Only use software approved by Schneider Electric for use with this equipment.
> - Update your application program every time you change the physical hardware configuration.
>
> **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

SoMachine is a professional, efficient and open OEM software solution that helps you develop, configure and commission the entire machine in a single environment (including logic, motor control, HMI and related network automation functions).

All information about SoMachine is included in the global SoMachine software help system.

### Communication Features

The 3 kinds of ports on the controller are:
- Ethernet port
- CANopen port
- USB port.

For more details, refer to the chapter Communication Connection *(see page 41)*.

### Fast I/O Functions

The ATV IMC provides high-speed inputs for high speed counting functions. Refer to Fast Inputs chapter *(see page 59)*.

# Chapter 2
## Installation

### What Is in This Chapter?

This chapter contains the following topics:

## Installation and Maintenance Requirements

### Before Starting

The use and application of the information contained herein require expertise in the design and programming of automated control systems. Only you, the user, machine builder or integrator, can be aware of all the conditions and factors present during installation and setup, operation, and maintenance of the machine or process, and can therefore determine the automation and associated equipment and the related safeties and interlocks which can be effectively and properly used. When selecting automation and control equipment, and any other related equipment or software, for a particular application, you must also consider any applicable local, regional or national standards and/or regulations.

Pay particular attention in conforming to any safety information, different electrical requirements, and normative standards that would apply to your machine or process in the use of this equipment.

Read and understand these instructions before performing any procedure with the drive.

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### ⚠ **WARNING**

**UNINTENDED EQUIPMENT OPERATION**

- Read and understand this manual before installing or operating the drive.
- Any changes made to the parameter settings must be performed by qualified personnel.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

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### Disconnect Drive Power

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### ⚠ ⚠ **DANGER**

**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- After disconnecting all power, wait for 15 minutes to allow the DC bus capacitors to discharge in the ATV drives.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

**Failure to follow these instructions will result in death or serious injury.**

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**NOTE:** The DC bus voltage can exceed 1000 Vdc. Use a properly rated voltage-sensing device when performing this procedure to measure the DC bus voltage.

### Operating Environment

| ⚠ **WARNING** |
|---|
| **UNINTENDED EQUIPMENT OPERATION OR INOPERABLE EQUIPMENT** |
| Do not operate or install any drive or drive accessory that appears damaged. |
| **Failure to follow these instructions can result in death, serious injury, or equipment damage.** |

| ⚠ **WARNING** |
|---|
| **LOSS OF CONTROL** |
| ● The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop, power outage and restart. |
| ● Separate or redundant control paths must be provided for critical control functions. |
| ● System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link. |
| ● Observe all accident prevention regulations and local safety guidelines.[1] |
| ● Each implementation of this equipment must be individually and thoroughly tested for proper operation before being placed into service. |
| **Failure to follow these instructions can result in death, serious injury, or equipment damage.** |

[1] For additional information, refer to NEMA ICS 1.1 (latest edition), Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control.

## First Startup

### Introduction

This procedure will help you through the first installation and start up of your device.

### Startup Procedure

| Step | Action |
|------|--------|
| 1 | Check that the card catalog number marked on the label is the same as on the delivery note corresponding to the purchase order |
| 2 | Remove the Altivar ATV IMC Drive Controller from its packaging and check that it has not been damaged in transit |
| 3 | Check that the product is complete: the packaging should contain the Altivar ATV IMC Drive Controller and a removable terminal |
| 4 | Follow the procedure described on Mounting Procedure *(see page 22)* to mount the card in the drive |

# Internal Battery

## Introduction

In the event of a power outage, the internal battery will retain the internal clock.

## Internal Battery

A clock backed up by a lithium battery makes it possible to have a log of events that have occurred.

When the Altivar ATV IMC Drive Controller is installed in the drive, events can be time and date-stamped, see programming guide.

The date and time need to be set on receipt of the Altivar ATV IMC Drive Controller, or after replacing its lithium battery.

When connected to the configuration software tool (SoMachine) the ATV IMC clock can be synchronized with the PC clock.

The date and time on this clock are checked and set from a special sub-menu in the [1.14 PROGRAMMABLE CARD] customizable menu in the graphic display terminal.

While lithium batteries are preferred due to their slow discharge and long life, they can present hazards to personnel, equipment and the environment and must be handled properly.

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## ⚠ DANGER

**EXPLOSION, FIRE, OR CHEMICAL BURNS**

- Replace with identical battery type.
- Follow all battery manufacturer's instructions.
- Remove all replaceable batteries before discarding unit.
- Recycle or properly dispose of used batteries.
- Protect battery from any potential short-circuit.
- Do not recharge, disassemble, heat above 100 °C (212 °F), or incinerate.
- Use your hands or insulated tools to remove or replace the battery.
- Maintain proper polarity when inserting and connecting a new battery.

**Failure to follow these instructions will result in death or serious injury.**

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## Mounting the Altivar ATV IMC Drive Controller in the Drive

### Mounting Procedure

**NOTE:**

If an Altivar ATV IMC Drive Controller and an I/O extension card are installed simultaneously:
- The I/O extension card must be installed on the drive first
- Then the Altivar ATV IMC Drive Controller must be installed on the I/O extension card.

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## ⚠⚠ DANGER

**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- After disconnecting all power, wait for 15 minutes to allow the DC bus capacitors to discharge in the ATV drives.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

**Failure to follow these instructions will result in death or serious injury.**

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## *NOTICE*

**INOPERABLE EQUIPMENT**

Do not apply power to the ATV IMC until it is properly installed in an ATV61 or ATV71 Drive Controller.

**Failure to follow these instructions can result in equipment damage.**

| Step | Action | Comment |
|------|--------|---------|
| 1 | Disconnect drive power | Wait for 15 minutes to allow the DC bus capacitors to discharge |
| 2 | Using a screwdriver, press down on the catch and pull to release the left-hand part of the control front panel of the drive | |
| 3 | Do the same on the right-hand side | |
| 4 | Pivot the control front panel and remove it | |
| 5 | Install the I/O extension card, if used | Refer to the I/O extension card instruction sheet |

| Step | Action | Comment |
|------|--------|---------|
| 6 | Position the Altivar ATV IMC Drive Controller on the clasps | |
| 7 | Then pivot it until it clicks into place | |
| 8 | Replace the control front panel over the Altivar ATV IMC Drive Controller. (same procedure as for installing the Altivar ATV IMC Drive Controller, see 6 and 7) | |

## User Configuration Switches

### Overview

The Altivar ATV IMC Drive Controller has a block of 4 switches as illustrated below:
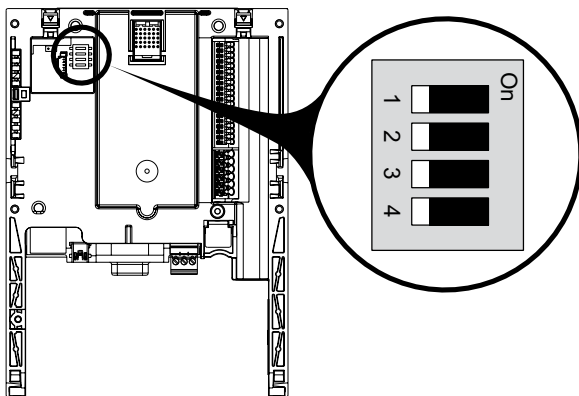


The user configuration switches are made available to the user application program, and can be used at your discretion for whatever purpose you see fit.

These switches can only be set when the drive and the Altivar ATV IMC Drive Controller are not under power, since it is necessary to remove the drive control front panel in order to access it.

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## ⚠⚠ DANGER

**HAZARD OF ELECTRIC SHOCK, EXPLOSION OR ARC FLASH**

- Disconnect all power from all equipment including connected devices prior to removing any covers or doors, or installing or removing any accessories, hardware, cables, or wires except under the specific conditions specified in the appropriate hardware guide for this equipment.
- After disconnecting all power, wait for 15 minutes to allow the DC bus capacitors to discharge in the ATV drives.
- Always use a properly rated voltage sensing device to confirm the power is off where and when indicated.
- Replace and secure all covers, accessories, hardware, cables, and wires and confirm that a proper ground connection exists before applying power to the unit.
- Use only the specified voltage when operating this equipment and any associated products.

**Failure to follow these instructions will result in death or serious injury.**

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The user configuration is set up by the 4 switches in binary count with low bit 1 and high bit 4.

Use the ReadSwitch *(see Altivar ATV IMC Drive Controller, ATV IMC UserLib Library Guide)* function block to read these switches.

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# Chapter 3
## Wiring

### What Is in This Chapter?

This chapter contains the following topics:

## Terminals of the Altivar ATV IMC Drive Controller

The following illustration describes the different terminals:
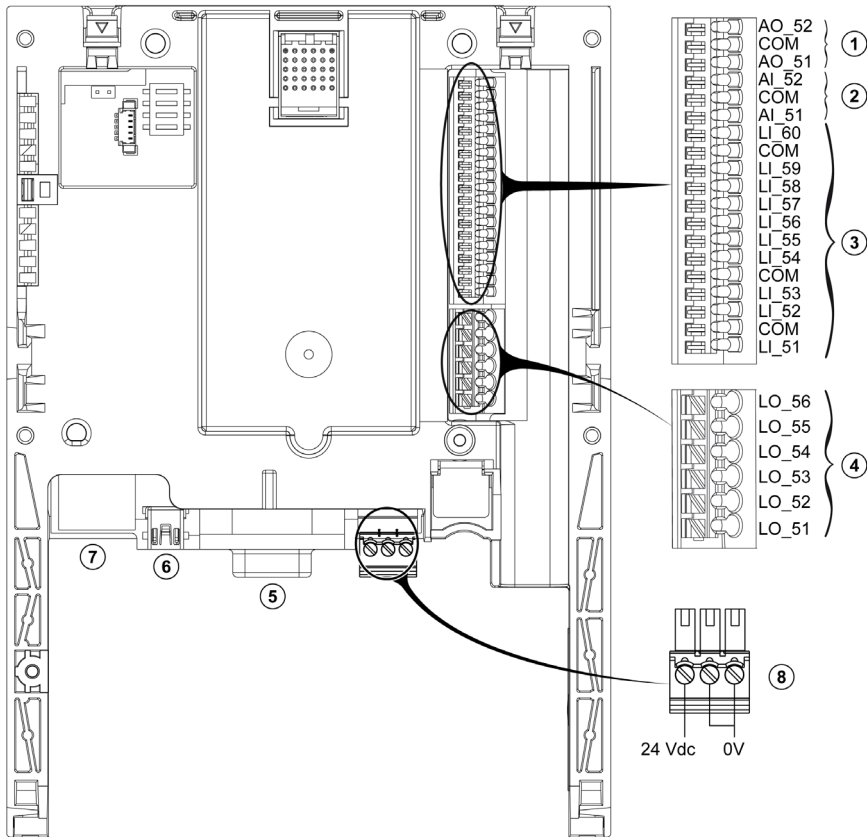


**1** Analog out
**2** Analog in
**3** Logic (Digital) Inputs
**4** Logic (Digital) Outputs
**5** CANopen SubD9
**6** Mini USB
**7** Ethernet RJ45
**8** 24 Vdc terminal block

# DC Power Supply Wiring and Characteristics

### 24 Vdc Terminal Block

The 24 Vdc terminal block is used to connect an optional external power supply to the Altivar ATV IMC Drive Controller, logic (digital) outputs and analog outputs.

If allowed by the power consumption table (for example, if outputs are not being used), the Altivar ATV IMC Drive Controller can be powered by the 24 Vdc power supply from the drive. Otherwise, an external power supply may be required.

If an external power supply is required, refer to your Schneider Electric catalog.
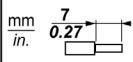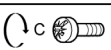
### COM and 0 V Terminals

The COM terminals and the 0 V terminal (of the 24 Vdc terminal block) of the Altivar ATV IMC Drive Controller are connected to the ATV IMC 0 V.

When mounted on a drive, the ATV IMC 0 V is connected to the 0 V of the drive.

### Rules for Removable Screw Terminal Block

The following table shows the wire types and sizes for the removable screw terminal block (8):

| $\frac{mm}{in.}$ 7 / 0.27 | | | | | |
|---|---|---|---|---|---|
| mm² | 0.14…1.5 | 0.25…0.5 | 2 x 0.08...0.5 | 2 x 0.08...0.75 | 2 x 0.5 |
| AWG | 26…14 | 24…20 | 2 x 28…20 | 2 x 28…18 | 2 x 20 |

| Ø 2 mm (0.079 in.) | C | N•m | 0.22 |
|---|---|---|---|
| | | lb-in | 1.95 |

## I/O Wiring and Characteristics

### Ground Shielded Cable Connection

In order to maintain a high level of resistance to electromagnetic interference, the use of shielded cables is required for Fast inputs.

To improve Electromagnetic Compatibility (EMC), use shielded cables for all inputs and outputs.

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## ⚠ WARNING

**UNINTENDED EQUIPMENT OPERATION**

- Connect all fast inputs with shielded cables.
- Properly ground the cable shields as indicated in this documentation.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

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### I/O Characteristics

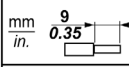The following table describes the characteristics of the I/O:

| I/O | Ref | Comment |
|---|---|---|
| Analog inputs | AI_51, AI_52 | • 2 current analog inputs 0…20 mA. Connect an impedance 250 Ω<br>• Or 2 voltage analog inputs 0...5 V<br><br>Resolution: 10 bits. Current and voltage configurable by library.<br>Accuracy: ± 1% for a temperature variation of 60° C (140° F)<br>Linearity: ± 0.4% of the maximum value<br>Common point for the card I/O [1] |
| Analog outputs | AO_51, AO_52 | 2 current analog outputs 0…20 mA, impedance 500 Ω<br>Resolution: 10 bits<br>Accuracy: ± 1% for a temperature variation of 60° C (140° F)<br>Linearity: ± 0.2% of the maximum value<br>Common point for the card I/O [1] |

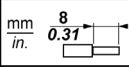| I/O | Ref | Comment |
|---|---|---|
| Logic (digital) inputs | LI_51…LI_60 | 10 logic (digital) 24 Vdc inputs:<br>● Inputs LI_51 and LI_59 can be configured as single phase counter.<br>● Inputs LI_51 and LI_52 can be configured for an incremental encoder (channel A = LI_51, channel B = LI_52).<br>● Inputs LI_59 and LI_60 can be configured for an incremental encoder (channel A = LI_59, channel B =LI_60).<br><br>Maximum voltage: 30 Vdc. Impedance 4.4 kΩ Switching thresholds:<br>● State 0 if ≤ 5 V or logic (digital) input not wired<br>● State 1 if ≥ 11 V<br><br>Common point for the card I/O [1] |
| Logic (digital) outputs | LO_51…LO_56 | 6 logic (digital) 24 Vdc outputs, positive logic, compatible with level 1 PLC, standard IEC 65A-68<br>Maximum switching voltage: 30 V<br>Maximum current: 200 mA maximum for logic (digital) outputs without external +24Vdc power supply.<br>With +24Vdc power supply, the maximum is 200mA for each logic (digital) output.<br>Common point for the card I/O [1] |

[1] This common point is also the drive 0V (COM).

## Rules for Spring Terminal Block

The following table shows the wire types and sizes for the spring terminal block (Analog inputs (2) / Analog outputs (1) / Logic inputs (3)):
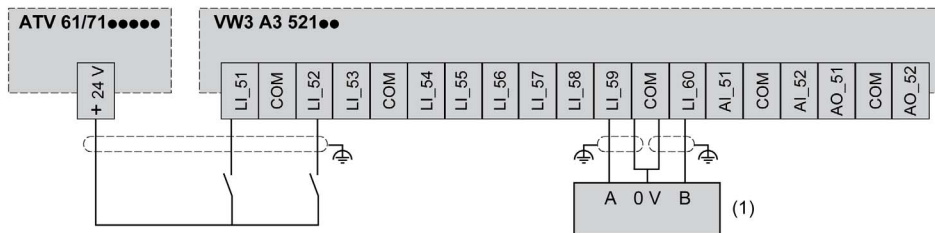
| $\frac{mm}{in.}$    **9** / **0.35** | | |
|---|---|---|
| mm² | 0.25…0.5 | |
| AWG | 24…20 | |

The following table shows the wire types and sizes for the spring terminal block (Logic outputs (4)):

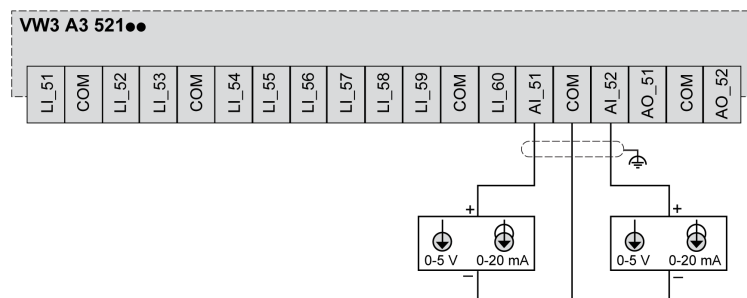| $\frac{mm}{in.}$    **8** / **0.31** | | |
|---|---|---|
| mm² | 0.5…1.5 | 0.5 |
| AWG | 20…14 | 20 |

## I/O Wiring Diagram
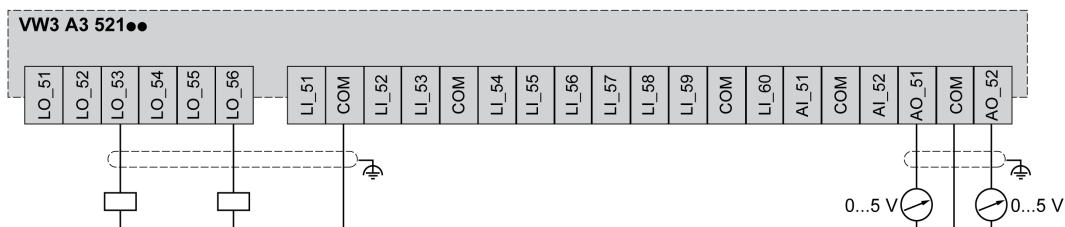
Logic (digital) inputs wiring diagram:



**(1)** Encoder
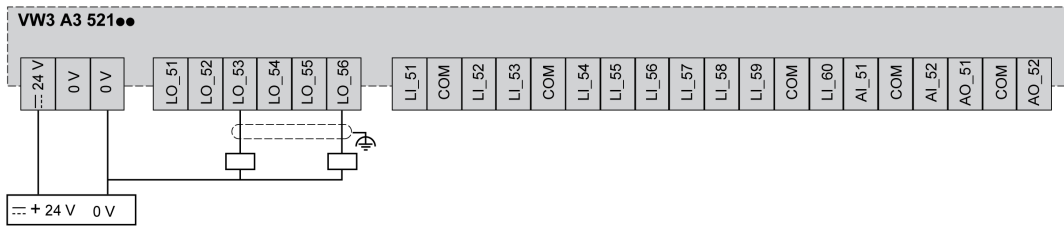
Analog inputs wiring diagram:



Logic (digital) and Analog outputs wiring diagram:



You can use the 24 Vdc power supply of the ATV drive only if the power consumption is less than 200 mA; otherwise, use an external power supply. When drive power supply is used and the logical (digital) output consumption exceeds 200 mA the card will set the logical output to zero.

External power supply wiring diagram:



VW3 A3 521●●

Terminals: 24 V, 0 V, 0 V, LO_51, LO_52, LO_53, LO_54, LO_55, LO_56, LI_51, COM, LI_52, LI_53, COM, LI_54, LI_55, LI_56, LI_57, LI_58, LI_59, COM, LI_60, AI_51, COM, AI_52, AO_51, COM, AO_52

+ 24 V   0 V

# Chapter 4
## Connecting to a PC

## Connecting the Altivar ATV IMC Drive Controller to a PC

### Introduction

To transfer and run applications, connect the Altivar ATV IMC Drive Controller to a PC with a properly installed version of SoMachine.

You can connect the Altivar ATV IMC Drive Controller to the PC by means of two different ways:
- USB-cable
- Ethernet connection

**NOTE:** To use the communication ports of the PC, stop the CoDeSys gateway by right-clicking the CoDeSys Gateway SysTray (running) icon from the taskbar and selecting the command Stop Gateway. This is mandatory if you want to use the Ethernet cable.

The communication cable should be connected to the PC first to minimize the possibility of electrostatic discharge affecting the controller.

| *NOTICE* |
|---|
| **INOPERABLE EQUIPMENT** |
| Always connect the communication cable to the PC before connecting it to the controller. |
| **Failure to follow these instructions can result in equipment damage.** |

**NOTE:** Only 1 controller should be connected to a computer at any given time. Do not connect multiple controllers simultaneously.
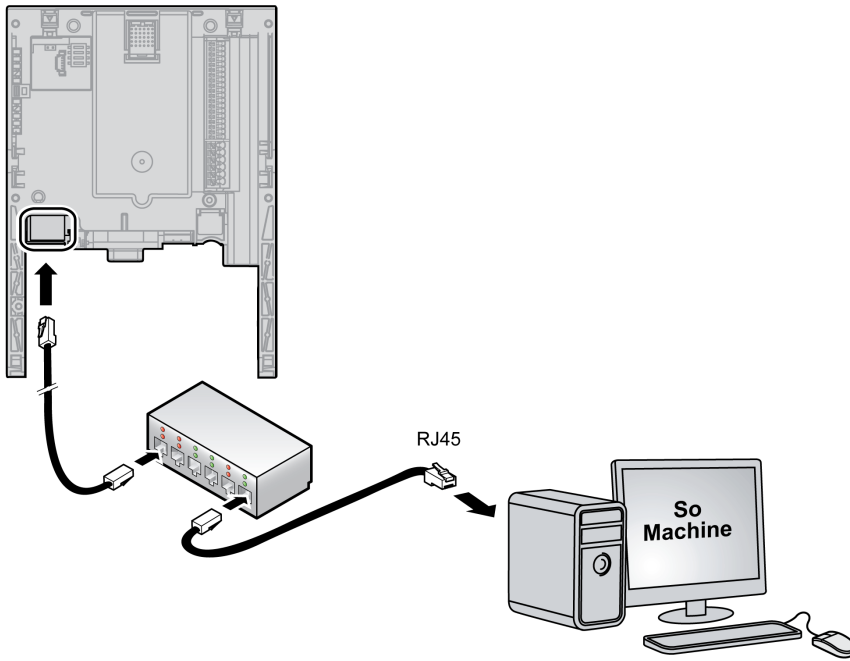
## Connecting Through Ethernet

The following illustration describes the Ethernet connection:

RJ45

So
Machine
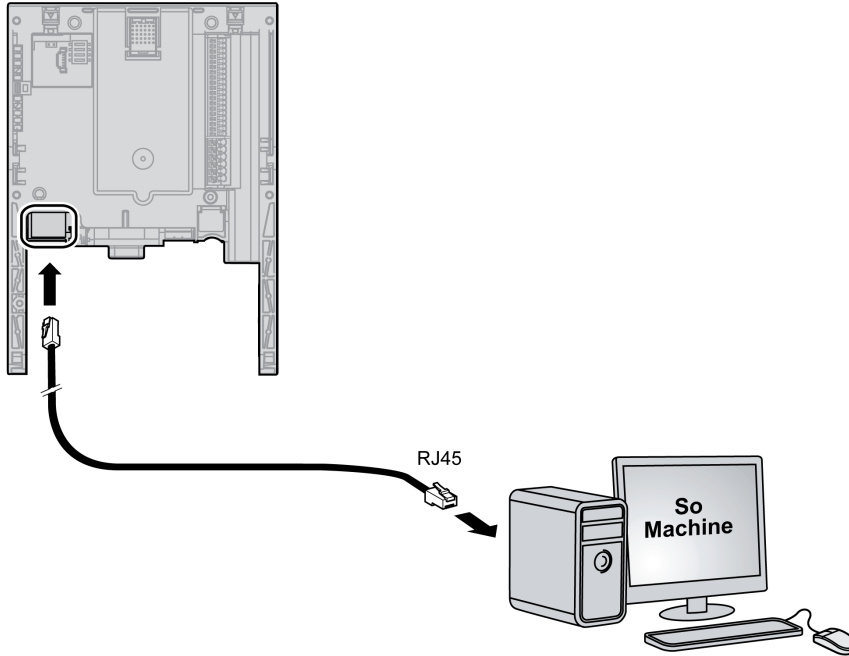
Please proceed as follows to connect the controller to the PC:
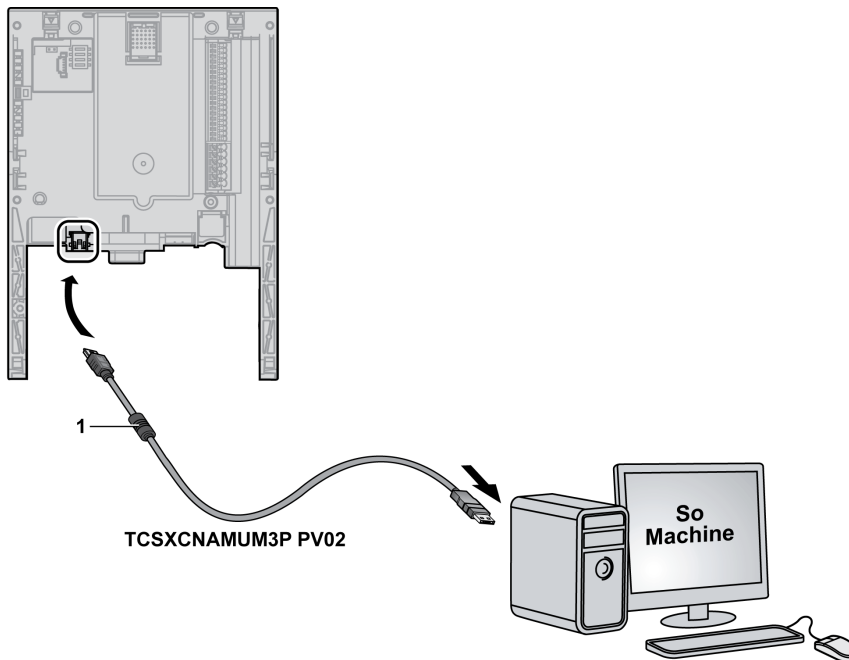
| Step | Action |
|------|--------|
| 1 | First connect the cable to the PC. |
| 2 | Then connect the cable to the controller. |

The following illustration describes the Ethernet connection with a HUB:

RJ45

So
Machine

## Connecting Through USB

The following illustration describes the Mini USB connection:



TCSXCNAMUM3P PV02

**1** Ferrite

---

# *NOTICE*

**INOPERABLE EQUIPMENT**

- Only use the USB cable TCSXCNAMUM3P PV02 (with ferrite).
- Do not use a USB cable extension.
- In case of high power drive, disconnect the PC from the ground and verify the ground connection between the drive and the motor.
- Always connect the communication cable to the PC before connecting it to the controller.

**Failure to follow these instructions can result in equipment damage.**

---

**NOTE:** High Power Drive references are ATV71H•••N4 or ATV61H•••N4 ≥ 90 kW (125HP) and ATV71H•••Y or ATV61H•••Y ≥ 110 kW (150HP).

### Access to the Control Terminals

To access the control terminals proceed as follows:
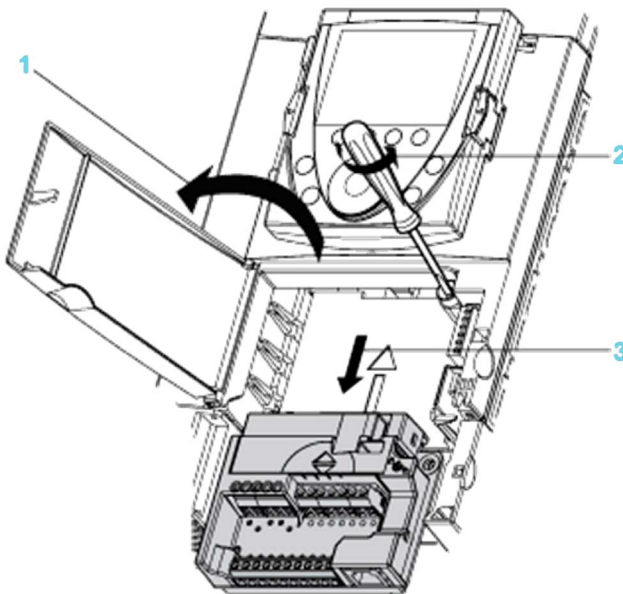


Remove power before opening the cover on the control front panel.

| Step | Action |
|---|---|
| 1 | To access the control terminals, open the cover on the control front panel. To make it easier to wire the drive control section, the control terminal card can be removed. |
| 2 | Loosen the screw until the spring is fully extended. |
| 3 | Remove the the card by sliding it downwards. Maximum wire size: 2.5 mm² - AWG 14 Max. tightening torque: 0.6 Nm - 5.3 lb-in |

# ⚠ WARNING

**UNSECURED TERMINAL CARD**

Fully tighten the captive-screw to a torque value of 1.1...1.7 Nm (9.7...15 lb-in) after replacing the control terminal card.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

S1A10252 04/2014

# Chapter 5
## Communication Connections

### What Is in This Chapter?

This chapter contains the following topics:

# Ethernet Connection

## Ethernet Capabilities

In order to be able to communicate via Ethernet, the Altivar ATV IMC Drive Controller includes, as standard, an Ethernet port.

This port allows communication using 2 protocols:
● SoMachine Network, for link with a PC (equipped with SoMachine software).
● TCP/Modbus, in order to meet the needs of Ethernet architectures with Schneider Electric or third party devices.

## Ethernet Connector Diagram
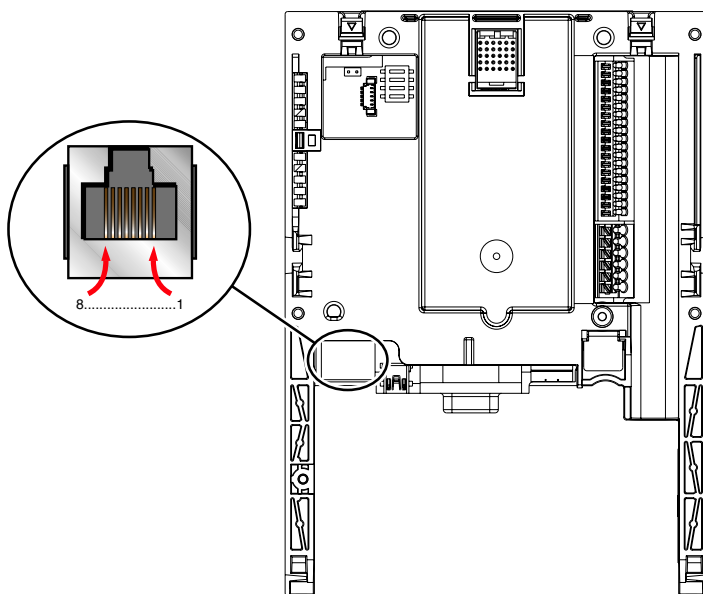


| Legend | | | | |
|--------|-------------|--|-----|-------------|
| Pin | Description | | Pin | Description |
| 1 | TD+ | | 5 | - |
| 2 | TD- | | 6 | RD- |
| 3 | RD+ | | 7 | - |
| 4 | - | | 8 | - |

### Address Format

The IP address by default is 10.10.x.x.

Where x is the last two fields in the default IP address. By default, they are the decimal equivalent of the last two hexadecimal bytes from the MAC address of the card.

The MAC address of the card can be retrieved on the card label placed on the internal right side of the card.

The Default Subnet Mask must be the Default Class A Subnet Mask of 255.0.0.0.

**NOTE:** To take into account the new IP address after the download of a project, reboot the controller by doing a power cycle.

### Example

For example, with the MAC address of 00-80-F4-DA-01-C4, you are concerned only with the last two bytes, 01-C4. Convert these bytes from hexadecimal to decimal.
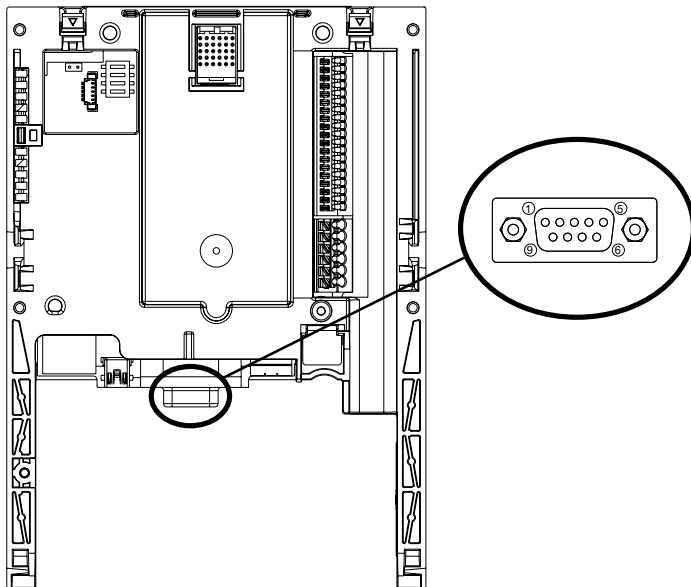
The hexadecimal values 01, and C4 have corresponding decimal values of 1, and 196, respectively.

These values are combined with the default IP address format (10.10.x.x) to yield a default IP address of 10.10.1.196.

# CANopen Connection

### Overview

The following illustration shows the location of the CAN port of the controller:



### CANopen Characteristics

| Structure | Connector | One 9-pin male SUB-D connector |
|---|---|---|
| | Network management | Master |
| | Transmission speed | Configurable via the program:<br>20 kbps, 50 kbps, 125 kbps, 250 kbps, 500 kbps, 800 kbps, 1 Mbps |
| | Address (NodeID) | 16 slaves maximum |

| Services | CANopen application layer | DS 301 V4.02 |
|---|---|---|
| | Channel configuration | DSP 405 |
| | PDO | 32 PDOs Tx, 32 PDOs Rx |
| | 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 |
| | Configuration | The CANopen network configurator is integrated in the SoMachine software. |

**NOTE:** Although SoMachine does not restrict you from doing so, you should not exceed more than 16 CANopen slave modules (and/or 32 TPDOs and 32 RPDOs) in order to have a sufficient performance tolerance and to avoid any performance degradation.

## ⚠ WARNING

**UNINTENDED EQUIPMENT OPERATION**

Do not connect more than 16 CANopen slave devices to the controller.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## *NOTICE*

**DEGRADATION OF PERFORMANCE**

Do not exceed more than 32 TPDOs and 32 RPDOs for the Altivar ATV IMC Drive Controller.

**Failure to follow these instructions can result in equipment damage.**

### Cable Length

Use a straight connector (For instance the cable VW3 M3 805R0 ••) to connect the Altivar ATV IMC Drive Controller to the CANopen bus.

It is not possible to use an angled connector because of the terminals located to the right of the CANopen connector.

The maximum length of the CANopen bus depends on the transmission speed on this bus. The table below indicates the maximum lengths permitted according to the transmission speed:

| Transmission speed | 20 kbps | 50 kbps | 125 kbps | 250 kbps | 500 kbps | 800 kbps | 1 Mbps |
|---|---|---|---|---|---|---|---|
| Max. length of bus | 2500 m (8202 ft) | 1000 m (3280 ft) | 500 m (1640 ft) | 200 m (656 ft) | 100 m (328 ft) | 40 m (131 ft) | 5 m (16 ft) |

## Pin Assignment

The 9-pin SUB-D connector on the Altivar ATV IMC Drive Controller is linked to the card ground and the drive ground.

| Legend | | | | |
|---|---|---|---|---|
| **Pin** | **Description** | | **Pin** | **Description** |
| 1 | N.C. | | 6 | CAN_SHLD |
| 2 | CAN_L | | 7 | CAN_H |
| 3 | CAN_GND | | 8 | N.C. |
| 4 | N.C. | | 9 | N.C. |
| 5 | N.C. | | | |

N.C.: Not Connected.

| ⚠ **WARNING** |
|---|
| **UNINTENDED EQUIPMENT OPERATION** |
| Do not connect wires to unused terminals and/or terminals indicated as "No Connection (N.C.)". |
| **Failure to follow these instructions can result in death, serious injury, or equipment damage.** |

## Status LED

| CAN LED | CANopen Status | Description |
|---|---|---|
| OFF | No CANopen configured | CANopen is not active in the application. |
| Single flash red / with green ON | Acceptable detected error limit threshold has been reached | The controller has detected that the maximum number of error frames has been reached or exceeded. |
| Double flash red / with green ON | Node Guarding or Heartbeat event | The controller has detected either a Node Guarding or Heartbeat exception for the CANopen master or slave device. |
| Red ON | Bus off | The CANopen bus is stopped. |
| Green ON | The CANopen bus is operational | |

# Chapter 6
## Configuration Using ATV Display

### Introduction

This chapter describes the ATV IMC configuration using the Altivar 61 local drive graphic or integrated display terminal.
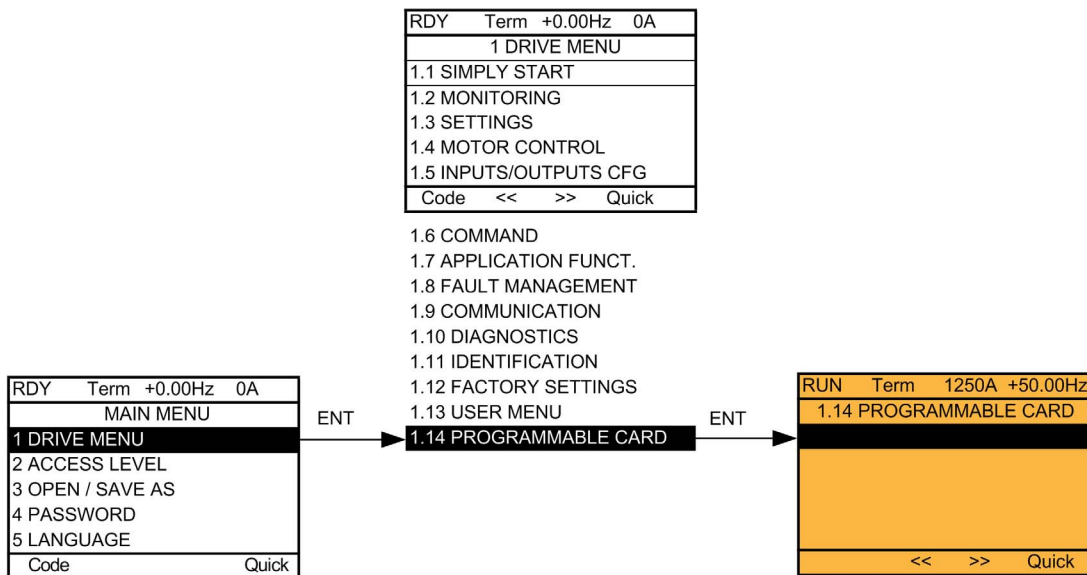
### What Is in This Chapter?

This chapter contains the following topics:

# First Start Configuration

## Configuration with Graphic Display terminal

When the ATV IMC card is inserted in the local drive, the [1.14 PROGRAMMABLE CARD] menu becomes accessible in the drive graphic display terminal menu organization:

```
RDY     Term  +0.00Hz   0A
          1 DRIVE MENU
1.1 SIMPLY START
1.2 MONITORING
1.3 SETTINGS
1.4 MOTOR CONTROL
1.5 INPUTS/OUTPUTS CFG
  Code    <<    >>    Quick
```

1.6 COMMAND
1.7 APPLICATION FUNCT.
1.8 FAULT MANAGEMENT
1.9 COMMUNICATION
1.10 DIAGNOSTICS
1.11 IDENTIFICATION
1.12 FACTORY SETTINGS
1.13 USER MENU
1.14 PROGRAMMABLE CARD

```
RDY     Term  +0.00Hz   0A
          MAIN MENU
1 DRIVE MENU
2 ACCESS LEVEL
3 OPEN / SAVE AS
4 PASSWORD
5 LANGUAGE
  Code                Quick
```

ENT

ENT

```
RUN    Term    1250A +50.00Hz
      1.14 PROGRAMMABLE CARD



                   <<    >>    Quick
```

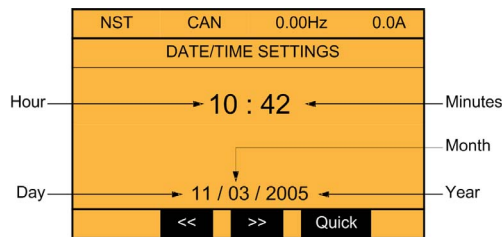## Altivar ATV IMC Drive Controller Modbus Address

The [Modbus add Prg C.] (AMOA) parameter can be set in the [1.14 PROGRAMMABLE CARD] menu.

This setting can also be accessed in the [1.9 - COMMUNICATION] menu, [MODBUS NETWORK] submenu.

## Setting Date and Time

In the [1.14 PROGRAMMABLE CARD] menu, [DATE/TIME SETTINGS] sub-menu, you can set:
● the year
● the month
● the day
● the hours
● the minutes



**NOTE:**

● The date and time formats are fixed.

## Menu customization

The [1.14 PROGRAMMABLE CARD] menu can be customized by configuration or programming.

The menu name and the parameters displayed in the menu can be customized.

Refer to ATV IMC Resident Drive Data Configuration *(see Altivar ATV IMC Drive Controller, Programming Guide)* for more details on customization by configuration.

Refer to Display Setting *(see Altivar ATV IMC Drive Controller, ATV IMC UserLib Library Guide)* for more details on customization by programming.

Example of a customized menu:

```
CYCLE IN PROGRESS

Current cycle              : 5

Current phase             : 2

Operation                 : dosing

Product                   : oil

Duration                  : 30 s


SETTINGS

Cycle selected            : 10

No. of phases             : 6

Phase selected            : 2

Operation sel             : mixing
```

| RUN | APP | +50.0 Hz | 2.1 A |
|-----|-----|----------|-------|
| | 1.14 DOSING | | ☐ |

CYCLE IN PROGRESS
Current cycle : 5
Current phase : 2
Operation : dosing
Product : oil ▼

| | | << | >> | | Quick | |

```
CYCLE IN PROGRESS

Current cycle              : 5

Current phase             : 2

Operation                 : dosing

Product                   : oil

Duration                  : 30 s




Cycle selected            : 10

No. of phases             : 6


Phase selected            : 2

Operation sel             : mixing
```

| RUN | APP | +50.0 Hz | 2.1 A |
|-----|-----|----------|-------|
| | 1.14 DOSING | | ▲ |

SETTINGS
Cycle selected : 10
No. of phases : 6
Phase selected : 2
Operation sel : mixin ▼

| | | << | >> | | Quick | |

## Configuration with Integrated Display Terminal

When the ATV IMC card is inserted in the local drive, the [1.14 PROGRAMMABLE CARD] menu becomes available in the drive integrated display terminal menu organization:

From the drive display terminal it is possible to access a dedicated Altivar ATV IMC Drive Controller submenu:
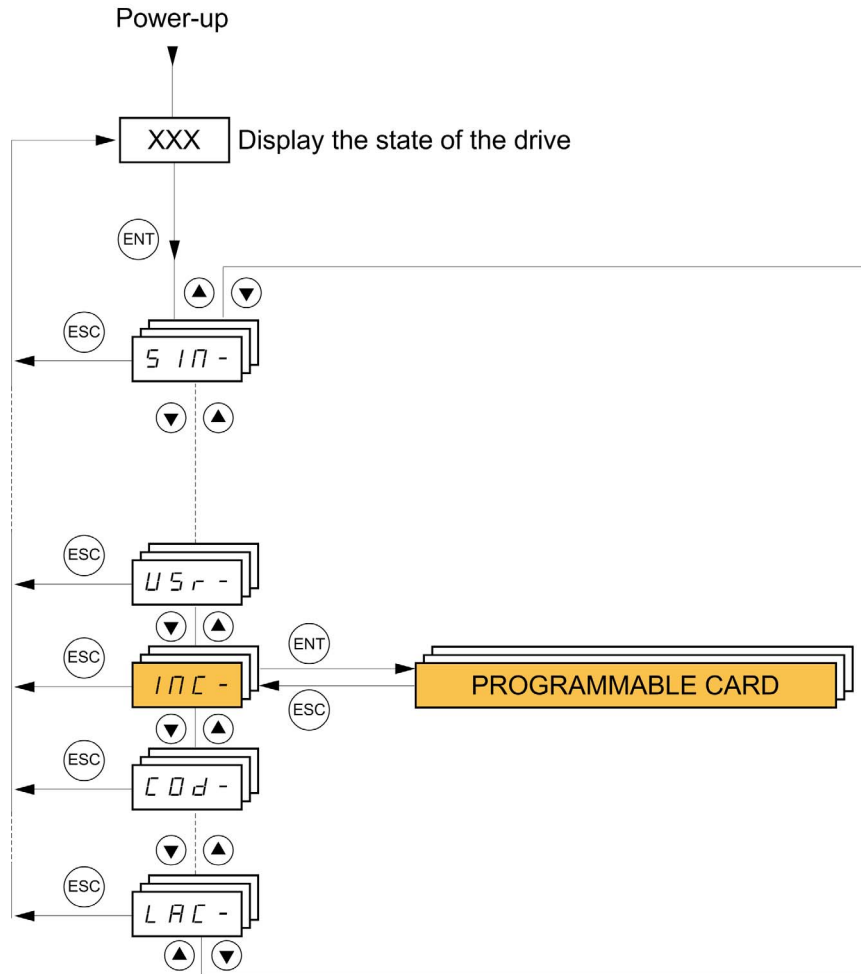
The ATV IMC PROGRAMMABLE CARD menu contains (when not customized) the following sub-menus:

- (AMOA) [Modbus add Prg C.]: ATV IMC Drive Controller Modbus Address
- rtC - [DATE/TIME SETTINGS] where you can set:
  - the year
  - the month
  - the day
  - the hours
  - the minutes

# Card Changed / Removed

### Option Card Changed or Removed

When an option card is removed or replaced by another, the drive locks in [Incorrect config.] mode on power-up.

If the card has been deliberately changed or removed, this can be cleared by pressing the ENT key twice, which causes the factory settings to be restored for the parameter groups affected by the card.

These are as follows:
- Altivar ATV IMC Drive Controller replaced by a card of the same type: [1.14 PROGRAMMABLE CARD]
- Altivar ATV IMC Drive Controller removed (or replaced by a different type of card): [Drive menu] and [1.14 PROGRAMMABLE CARD] .

### Altivar ATV IMC Drive Controller Modbus Address

When an ATV IMC option card is replaced by another, its modbus address is OFF by default. If the card is plugged on a netwrok or remote link, you must configure the [Modbus add Prg C.] AMOA parameter.

---

## ⚠ WARNING

**UNINTENDED EQUIPMENT OPERATION**

- Be sure that there is only one master controller configured on the network or remote link.
- Be sure that all slave devices have unique addresses such that two or more slaves do not have the same address.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

---

# Chapter 7
## ATV IMC Operations

### Diagnostic

#### LED

The Altivar ATV IMC Drive Controller is equipped with five LEDs which can be seen through the window in the Altivar cover.
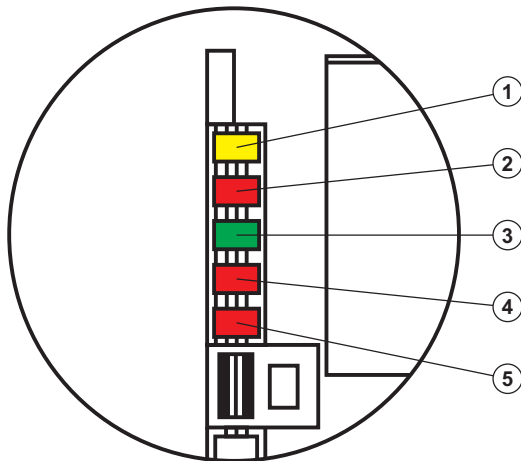


| LED | State | Meaning |
|---|---|---|
| 1<br>G/Y ETH<br>(Ethernet activity) | Off | No link |
| | Flashing Green/yellow | Power up testing. Flashing 3 times |
| | Green On | Link at 100 Mbps |
| | Yellow On | Link at 10 Mbps |
| | Green flash | Activity at 100 Mbps |
| | Yellow flash | Activity at 10 Mbps |

| LED | State | Meaning |
|---|---|---|
| 2<br>G/R NS<br>(Network Status) | Off | The ATV IMC does not have an IP address or is powered off. |
| | Flashing Green/red | Power testing. Flashing 3 times |
| | Green On | The ATV IMC has at least one established connection (even to the Message Router). |
| | Green flashing | The ATV IMC has not established connections, but has obtained an IP address. |
| | Red flashing | One or more of the connections in which this ATV IMC is the target has timed out. This LED will remain flashing until all time out connections are reestablished or if the ATV IMC is reset.<br>The ATV IMC is in the HALT state. |
| | Red On | The ATV IMC has detected that its IP address is already in use.<br>The ATV IMC is in the HALT state. |
| 3<br>G/R MS<br>RUN/STOP<br>(Module Status) | Off | No power is supplied to the ATV IMC. |
| | Flashing Green/red | The ATV IMC is BOOTING. All LEDs flashing 3 times |
| | Green On | The application is in RUNNING state. |
| | Green flashing | The application is in STOPPED state. |
| | Red flashing | The application has detected a recoverable event. |
| | Red on | The application has detected a non-recoverable event (Hardware watchdog or internal error detected). |
| 4<br>G/R CAN<br>RUN/ERROR<br>(CANopen) | CANopen RUN / green off | CANopen master in STOPPED state |
| | CANopen RUN / flashing | CANopen master in PRE-OPERATIONAL state |
| | CANopen RUN / on | CANopen master in OPERATIONAL state |
| | CANopen ERROR / 1 flash per second | The CANopen master error counter has reached or exceeded its warning level (too many errors detected). |
| | CANopen ERROR / 2 flashes per second | Node Guarding error (opposite a CANopen slave) or Heartbeat error (CANopen master acting as consumer) |
| | CANopen ERROR / on | The CANopen master is in the "OFF" state. |
| 5<br>G/R USER | Defined by the user | - |
| All LEDs | Flashing | Identification of the logic controller. For more information, refer to SoMachine Programming Guide. |

## ATV Display

The values of the Altivar ATV IMC Drive Controller logic and analog I/O can be displayed on the graphic display terminal: [1.2 - MONITORING] menu, [Controller Inside I/O MAP] sub-menu.

| RUN | Term | + 50.00Hz | 80A |
|---|---|---|---|
| | Controller Inside I/O MAP | | |
| C. INSIDE CARD LI MAP | | | |
| Controller inside AI MAP | | | |
| C. INSIDE CARD LO MAP | | | |
| Controller inside AO MAP | | | |
| | | | |
| Code | | | Quick |

Move from one screen to another (from C. INSIDE CARD LI MAP to Controller inside AO MAP) by turning the navigation button

state 0
state 1

| RUN | Term | + 50.00Hz | 80A |
|---|---|---|---|
| | C. INSIDE CARD LI MAP | | |

LI51  LI52  LI53  LI54  LI55   LI56  LI57
LI58

LI59  LI60

| Code | << | >> | Quick |

| RUN | Term | + 50.00Hz | 80A |
|---|---|---|---|
| | Controller inside AI MAP | | |
| AI51 | : | 0.000 mA | |
| AI52 | : | 9.87 V | |
| Code | << | >> | Quick |

ENT →

| RUN | Term | + 50.00Hz | 80A |
|---|---|---|---|
| | AI51 | | |
| | 0 mA | | |
| Min = 0.001 | Max = 20,000 | | |
| | << | >> | Quick |

state 0
state 1

| RUN | Term | + 50.00Hz | 80A |
|---|---|---|---|
| | C. INSIDE CARD LO MAP | | |

LO51 LO52 LO53 LO54 LO55 LO56

| | << | >> | Quick |

| RUN | Term | + 50.00Hz | 80A |
|---|---|---|---|
| | Controller inside AO MAP | | |
| AO51 | : | 0.000 mA | |
| AO52 | : | 9.87 V | |
| Code | << | >> | Quick |

ENT →

| RUN | Term | + 50.00Hz | 80A |
|---|---|---|---|
| | AO51 | | |
| | 0 mA | | |
| Min = 0.001 | Max = 20,000 | | |
| | << | >> | Quick |

## Event Monitoring

[internal com. link] is displayed when:
● There is a hardware error detected.
● A communication interruption occurs between the Altivar ATV IMC Drive Controller and the drive.

The drive behavior cannot be configured when [internal com. link] is displayed. The drive performs a freewheel stop. This can only be reset by performing a power reset on the drive.

Two diagnostic parameters can be used to obtain more detailed information on the cause of [internal com. link]:
● [Internal link fault 1] indicates option card no. 1 (installed directly on the drive).
● [Internal link fault 2] indicates option card no. 2 (installed directly on the drive).

The Altivar ATV IMC Drive Controller can be in position 1 or in position 2.

Parameters [Internal link fault 1] and [Internal link fault 2] can only be accessed on the graphic display terminal, in the [1.10 DIAGNOSTICS], [MORE FAULT INFO] menu.

# Chapter 8
## Fast Inputs

### What Is in This Chapter?

This chapter contains the following topics:

## HSC Modes

### Introduction

Altivar ATV IMC Drive Controller implements two High Speed Counters (HSC): HSC 0 and HSC 1.

High Speed Counter functionalities are divided in two families:
- Simple Mode for basic functions
  - Counting down one shot,
  - Counting down modulo.

- Main Mode for "complex" functions
  - Counting one shot,
  - Counting modulo,
  - Counting up/down free (for quadrature encoder and other speed or position sensors),
  - Event counting,
  - Frequency meter.

Altivar ATV IMC Drive Controller has 6 fast inputs and 4 general-purpose logical inputs. Most of all these inputs can be used for the High Speed Counter.

### HSC I/O Mapping

The table below shows the availability of the HSC functions according to the inputs:

| Digital input | Fast input [1] | Usage for HSC | |
| --- | --- | --- | --- |
| | | HSC fast input | HSC general input |
| LI_51 | X | X | X |
| LI_52 | X | X | X |
| LI_53 | X | | |
| LI_54 | X | | |
| LI_55 | | | |
| LI_56 | | | X |
| LI_57 | | | X |
| LI_58 | | | |
| LI_59 | X | X | X |
| LI_60 | X | X | X |

[1] 100 kHz, 24 V ± 10%

# ⚠ **WARNING**

**UNINTENDED EQUIPMENT OPERATION**

● Connect all fast inputs with shielded cables.
● Properly ground the cable shields as indicated in this documentation.

**Failure to follow these instructions can result in death, serious injury, or equipment damage.**

## HSC Simple Mode

### One Shot

The One Shot counter mode allows you to count a predefined number of pulses.

**Principle:** The counter starts decreasing from a preset value of a synchronization function. The decrease is made by each pulse applied to the leading edge of the synchronization input. The counter stops when its current value reaches 0 and the done bit is set. At this point, the counter current value is not modified by any new pulses from the input. The counter waits for the next synchronization to restart.

Example: The preset value may be a number of pieces to be packaged and the output may stop the packaging function or make a light go on.

### Modulo

The Modulo Loop counter mode is used for applications for which actions are repetitive.

Configured in counting down modulo, the counter repeatedly counts from a user-defined value to 0.

## HSC Main Modes

### One Shot

This mode is the same as the one defined in HSC Simple. The difference is that "Enable" and "Preset" signals can be triggered by hardware inputs and the synchronization (edge configuration) can be configured on (rising or falling edge).

### Modulo

This mode is the same as the one defined in HSC Simple. The difference is that "Enable" and "Preset" signals can be triggered by hardware inputs and the synchronization (edge configuration) can be configured (rising or falling edge for enable. The preset is only on rising edge).

### Free

The Free Large counter mode is for axis monitoring or labeling where the incoming position of each part has to be known.

Input Modes:
- "A" is first clock, "B" is second clock, direction is given by signal phase, Z signal can be used to preset,
  - Normal Quadrature X1, X2, X4,
  - Reverse Quadrature X1, X2, X4,
- "A" is first clock, "B" is direction, Z signal be used to preset.

### Event Counting

The Event Counting mode is used to count a sequence of events over a given period of time.

**Principle**: The counter assesses the number of pulses applied on the input for a predefined period of time. The counting register is updated at the end of each period with the number of events received.

The event counter can be used while the synchronization bit is set to 1. Setting the bit to one starts the event counting for a predefined time period. The counting restarts at the rising edge or at the falling edge of the synchronization input.

To find out how to configure this mode refer to the SoMachine Online Help.

### Frequency Meter

The Frequency Meter mode allows the measurement of an event's frequency, speed, rate or flow.

**Principle**: The measured frequency is a mean frequency: number of events in the time interval converted to number of events per second (Hz).

To find out how to configure this mode refer to the SoMachine Online Help.

# Chapter 9
## Altivar ATV IMC Drive Controller Performances

## Performances

### Logic Processing

The following table shows nominal logic processing performance for various logical instructions:

| IL Instruction Type | Duration for 1000 instructions in microseconds (µs) |
|---|---|
| Addition/subtraction/multiplication of INT | 350 |
| Addition/subtraction/multiplication of DINT | 350 |
| Addition/subtraction/multiplication of REAL | 362 |
| Division of REAL | 690 |
| Operation on BOOLEAN, e.g. Status:= Status and value | 942 |
| LD INT + ST INT | 249 |
| LD DINT + ST DINT | 248 |
| LD REAL + ST REAL | 296 |

### Communication and System Processing Time

The communication processing time varies, depending on the number of send/receive requests.

# Glossary

## A

**AMOA**

Drive parameter that contains the Modbus address of the ATV IMC drive controller.

**analog input**

Converts received voltage or current levels into numerical values. You can store and process these values within the logic controller.

**analog output**

Converts numerical values within the logic controller and sends out proportional voltage or current levels.

**application**

A program including configuration data, symbols, and documentation.

**ASCII**

(*American standard code for Information Interchange*) A protocol for representing alphanumeric characters (letters, numbers, certain graphics, and control characters).

**ATV**

The model prefix for Altivar drives (for example, ATV312 refers to the Altivar 312 variable speed drive).

**AWG**

(*American wire gauge*) The standard that specifies wire section sizes in North America.

## B

**byte**

A type that is encoded in an 8-bit format, ranging from `16#00` to `16#FF` in hexadecimal representation.

## C

**CAN**

(*controller area network*) A protocol (ISO 11898) for serial bus networks, designed for the interconnection of smart devices (from multiple manufacturers) in smart systems and for real-time industrial applications. Originally developed for use in automobiles, CAN is now used in a variety of industrial automation control environments.

**CANopen**

An open industry-standard communication protocol and device profile specification (EN 50325-4).

**CFC**

> (*continuous function chart*) A graphical programming language (an extension of the IEC 61131-3 standard) based on the function block diagram language that works like a flowchart. However, no networks are used and free positioning of graphic elements is possible, which allows feedback loops. For each block, the inputs are on the left and the outputs on the right. You can link the block outputs to the inputs of other blocks to create complex expressions.

**configuration**

> The arrangement and interconnection of hardware components within a system and the hardware and software parameters that determine the operating characteristics of the system.

**controller**

> Automates industrial processes (also known as programmable logic controller or programmable controller).

# D

**DINT**

> (*double integer type*) Encoded in 32-bit format.

# E

**encoder**

> A device for length or angular measurement (linear or rotary encoders).

**Ethernet**

> A physical and data link layer technology for LANs, also known as IEE 802.3.

# F

**FBD**

> (*function block diagram*) One of 5 languages for logic or control supported by the standard IEC 61131-3 for control systems. Function block diagram is a graphically oriented programming language. It works with a list of networks, where each network contains a graphical structure of boxes and connection lines, which represents either a logical or arithmetic expression, the call of a function block, a jump, or a return instruction.

**firmware**

> Represents the BIOS, data parameters, and programming instructions that constitute the operating system on a controller. The firmware is stored in non-volatile memory within the controller.

**function**

A programming unit that has 1 input and returns 1 immediate result. However, unlike FBs, it is directly called with its name (as opposed to through an instance), has no persistent state from one call to the next and can be used as an operand in other programming expressions.

Examples: boolean (AND) operators, calculations, conversions (BYTE_TO_INT)

# H

**HMI**

(*human machine interface*) An operator interface (usually graphical) for human control over industrial equipment.

**HSC**

(*high-speed counter*)

# I

**I/O**

(*input/output*)

**ID**

(*identifier/identification*)

**IEC**

(*international electrotechnical commission*) A non-profit and non-governmental international standards organization that prepares and publishes international standards for electrical, electronic, and related technologies.

**IEC 61131-3**

Part 3 of a 3-part IEC standard for industrial automation equipment. IEC 61131-3 is concerned with controller programming languages and defines 2 graphical and 2 textual programming language standards. The graphical programming languages are ladder diagram and function block diagram. The textual programming languages include structured text and instruction list.

**IL**

(*instruction list*) A program written in the language that is composed of a series of text-based instructions executed sequentially by the controller. Each instruction includes a line number, an instruction code, and an operand (refer to IEC 61131-3).

**INT**

(*integer*) A whole number encoded in 16 bits.

**IP**

(*Internet protocol* Part of the TCP/IP protocol family that tracks the Internet addresses of devices, routes outgoing messages, and recognizes incoming messages.

# L

**LD**

(*ladder diagram*) A graphical representation of the instructions of a controller program with symbols for contacts, coils, and blocks in a series of rungs executed sequentially by a controller (refer to IEC 61131-3).

**LED**

(*light emitting diode*) An indicator that illuminates under a low-level electrical charge.

# M

**MAC address**

(*media access control address*) A unique 48-bit number associated with a specific piece of hardware. The MAC address is programmed into each network card or device when it is manufactured.

**machine**

Consists of several *functions* and/or *equipment*.

**Modbus**

The protocol that allows communications between many devices connected to the same network.

# N

**network**

A system of interconnected devices that share a common data path and protocol for communications.

**node**

An addressable device on a communication network.

# P

**PDO**

(*process data object*) An unconfirmed broadcast message or sent from a producer device to a consumer device in a CAN-based network. The transmit PDO from the producer device has a specific identifier that corresponds to the receive PDO of the consumer devices.

**PLC**

(*programmable logic controller*) An industrial computer used to automate manufacturing, industrial, and other electromechanical processes. PLCs are different from common computers in that they are designed to have multiple input and output arrays and adhere to more robust specifications for shock, vibration, temperature, and electrical interference among other things.

**Profibus DP**

(*Profibus decentralized peripheral*) An open bus system uses an electrical network based on a shielded 2-wire line or an optical network based on a fiber-optic cable. DP transmission allows for high-speed, cyclic exchange of data between the controller CPU and the distributed I/O devices.

**program**

The component of an application that consists of compiled source code capable of being installed in the memory of a logic controller.

**protocol**

A convention or standard definition that controls or enables the connection, communication, and data transfer between 2 computing system and devices.

# R

**REAL**

A data type that is defined as a floating-point number encoded in a 32-bit format.

**run**

A command that causes the controller to scan the application program, read the physical inputs, and write to the physical outputs according to solution of the logic of the program.

# S

**SDO**

(*service data object*) A message used by the field bus master to access (read/write) the object directories of network nodes in CAN-based networks. SDO types include service SDOs (SSDOs) and client SDOs (CSDOs).

**SFC**

(*sequential function chart*) A language that is composed of steps with associated actions, transitions with associated logic condition, and directed links between steps and transitions. (The SFC standard is defined in IEC 848. It is IEC 61131-3 compliant.)

**ST**

(*structured text*) A language that includes complex statements and nested instructions (such as iteration loops, conditional executions, or functions). ST is compliant with IEC 61131-3.

**STOP**

A command that causes the controller to stop running an application program.

# T

**task**

A group of sections and subroutines, executed cyclically or periodically for the MAST task or periodically for the FAST task.

A task possesses a level of priority and is linked to inputs and outputs of the controller. These I/O are refreshed in relation to the task.

A controller can have several tasks.

**TCP**

(*transmission control protocol*) A connection-based transport layer protocol that provides a simultaneous bi-directional transmission of data. TCP is part of the TCP/IP protocol suite.

**terminal block**

(*terminal block*) The component that mounts in an electronic module and provides electrical connections between the controller and the field devices.

# W

**watchdog**

A watchdog is a special timer used to ensure that programs do not overrun their allocated scan time. The watchdog timer is usually set to a higher value than the scan time and reset to 0 at the end of each scan cycle. If the watchdog timer reaches the preset value, for example, because the program is caught in an endless loop, a fault is declared and the program stopped.

**WORD**

A type encoded in a 16-bit format.