

# Altivar Process ATV600

## Application Note

### Multi-Drives Standard Level Control

01/2017



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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.

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# 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 inform 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, **results 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.

## Intended Use

This product is a drive for three-phase synchronous and asynchronous motors and intended for industrial use according to this manual. The product may only be used in compliance with all applicable safety regulations and directives, the specified requirements and the technical data. Prior to using the product, you must perform a risk assessment in view of the planned application. Based on the results, the appropriate safety measures must be implemented. Since the product is used as a component in an entire system, you must ensure the safety of persons by means of the design of this entire system (for example, machine design). Any use other than the use explicitly permitted is prohibited and can result in hazards. Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel.

## Product Related Information

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

### **DANGER**

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

- Only appropriately trained persons who are familiar with and understand the contents of this manual and all other pertinent product documentation and who have received safety training to recognize and avoid hazards involved are authorized to work on and with this drive system. Installation, adjustment, repair and maintenance must be performed by qualified personnel.
- The system integrator is responsible for compliance with all local and national electrical code requirements as well as all other applicable regulations with respect to grounding of all equipment.
- Many components of the product, including the printed circuit boards, operate with mains voltage. Do not touch.
- Only use properly rated, electrically insulated tools and measuring equipment.
- Do not touch unshielded components or terminals with voltage present.
- Motors can generate voltage when the shaft is rotated. Prior to performing any type of work on the drive system, block the motor shaft to prevent rotation.
- AC voltage can couple voltage to unused conductors in the motor cable. Insulate both ends of unused conductors of the motor cable.
- Do not short across the DC bus terminals or the DC bus capacitors or the braking resistor terminals.
- Before performing work on the drive system:
  - Disconnect all power, including external control power that may be present.
  - Place a **Do Not Turn On** label on all power switches related to the drive system.
  - Lock all power switches in the open position.
  - Wait 15 minutes to allow the DC bus capacitors to discharge.
  - Follow the instructions given in the chapter "Verifying the Absence of Voltage" in the installation manual of the product.
- Before applying voltage to the drive system:
  - Verify that the work has been completed and that the entire installation cannot cause hazards.
  - If the mains input terminals and the motor output terminals have been grounded and short-circuited, remove the ground and the short circuits on the mains input terminals and the motor output terminals.
  - Verify proper grounding of all equipment.
  - Verify that all protective equipment such as covers, doors, grids is installed and/or closed

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

Drive systems may perform unexpected movements because of incorrect wiring, incorrect settings, incorrect data or other errors.

## **WARNING**

### **UNANTICIPATED EQUIPMENT OPERATION**

- Carefully install the wiring in accordance with the EMC requirements.
- Do not operate the product with unknown or unsuitable settings or data.
- Perform a comprehensive commissioning test.

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

Damaged products or accessories may cause electric shock or unanticipated equipment operation.

## **DANGER**

### **ELECTRIC SHOCK OR UNANTICIPATED EQUIPMENT OPERATION**

Do not use damaged products or accessories.

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

Contact your local Schneider Electric sales office if you detect any damage whatsoever.

## **WARNING**

### **LOSS OF CONTROL**

- The designer of any control scheme must consider the potential failure modes of control paths and, for 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, 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 the product 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 USA: 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.

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

Machines, controllers, and related equipment are usually integrated into networks. Unauthorized persons and malware may gain access to the machine as well as to other devices on the network/fieldbus of the machine and connected networks via insufficiently secure access to software and networks.

 **WARNING**

**UNAUTHORIZED ACCESS TO THE MACHINE VIA SOFTWARE AND NETWORKS**

- In your hazard and risk analysis, consider all hazards that result from access to and operation on the network/fieldbus and develop an appropriate cyber security concept.
- Verify that the hardware infrastructure and the software infrastructure into which the machine is integrated as well as all organizational measures and rules covering access to this infrastructure consider the results of the hazard and risk analysis and are implemented according to best practices and standards covering IT security and cyber security (such as: ISO/IEC 27000 series, Common Criteria for Information Technology Security Evaluation, ISO/ IEC 15408, IEC 62351, ISA/IEC 62443, NIST Cybersecurity Framework, Information Security Forum - Standard of Good Practice for Information Security).
- Verify the effectiveness of your IT security and cyber security systems using appropriate, proven methods.

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

# About the Book



## At a Glance

### Document Scope

The purpose of this document is to show how to configure a Multi-Drives Standard Level Control.

The document is structured in six main parts which are:

- Overview: this part gives an approach of Altivar Process ATV600 capabilities inside process industry.
- Application Description: this part provides the application and architecture selected for this application note.
- Prerequisites: this part provides the minimum steps to achieve before starting the Level Control commissioning.
- MultiPump Configuration: this part provides the steps to configure the Multi-Drives Architecture and MultiDrive Link feature.
- Level Control: this part provides the minimum steps to achieve to configure the Level Control application
- Additional Parameters: this part provides details on parameters which allow advanced configuration of the Level Control application.

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

### Validity Note

This document is valid for the Altivar Process ATV600 drives.

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

Step	Action
1	Go to Schneider Electric home page <a href="http://www.schneider-electric.com">www.schneider-electric.com</a>
2	In the <b>Search</b> box type the reference of a product or the name of a product range. <ul style="list-style-type: none"><li>• Do not include blank spaces in the model number/product range.</li><li>• To get information on grouping similar modules, use asterisks (*).</li></ul>
3	If you entered a reference, go to the <b>Product Datasheets</b> search results and click on the reference that interests you. If you entered the name of a product range, go to the <b>Product Ranges</b> search results and click on the product range that interests you
4	If more than one reference appears in the <b>Products</b> 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 <b>Download XXX product datasheet.</b>

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

Use your tablet or your PC to quickly access detailed and comprehensive information on all our products on [www.schneider-electric.com](http://www.schneider-electric.com)

The internet site provides the information you need for products and solutions

- The whole catalog for detailed characteristics and selection guides
- The CAD files to help design your installation, available in over 20 different file formats
- All software and firmware to maintain your installation up to date
- A large quantity of White Papers, Environment documents, Application solutions, Specifications... to gain a better understanding of our electrical systems and equipment or automation
- And finally all the User Guides related to your drive, listed below:

Title of Documentation	Reference Number
ATV600 Getting Started	<a href="#">EAV63253</a> (English), <a href="#">EAV63254</a> (French), <a href="#">EAV63255</a> (German), <a href="#">EAV63256</a> (Spanish), <a href="#">EAV64310</a> (Italian), <a href="#">EAV64298</a> (Chinese)
ATV600 Getting Started Annex (SCCR)	<a href="#">EAV64300</a> (English)
ATV630, ATV650 Installation Manual	<a href="#">EAV64301</a> (English), <a href="#">EAV64302</a> (French), <a href="#">EAV64306</a> (German), <a href="#">EAV64307</a> (Spanish), <a href="#">EAV63257</a> (Italian), <a href="#">EAV64317</a> (Chinese)
ATV630, ATV650 Programming Manual	<a href="#">EAV64318</a> (English), <a href="#">EAV64320</a> (French), <a href="#">EAV64321</a> (German), <a href="#">EAV64322</a> (Spanish), <a href="#">EAV64323</a> (Italian), <a href="#">EAV64324</a> (Chinese)
ATV600 Modbus Serial Link Manual	<a href="#">EAV64325</a> (English)
ATV600 Ethernet Manual (Embedded)	<a href="#">EAV64327</a> (English)
ATV600 Ethernet IP - Modbus TCP Manual (VW3A3720, VW3A3721)	<a href="#">EAV64328</a> (English)
ATV600 PROFIBUS DP manual (VW3A3607)	<a href="#">EAV64329</a> (English)
ATV600 DeviceNet manual (VW3A3609)	<a href="#">EAV64330</a> (English)
ATV600 PROFINET manual (VW3A3627)	<a href="#">EAV64331</a> (English)
ATV600 CANopen manual (VW3A3608, 618, 628)	<a href="#">EAV64333</a> (English)
ATV600 Communication Parameters	<a href="#">EAV64332</a> (English)
ATV600 Safety Function manual	<a href="#">EAV64334</a> (English)
Altivar Process Drive Systems - Installation manual	<a href="#">NHA37119</a> (English), <a href="#">NHA37121</a> (French), <a href="#">NHA37118</a> (German), <a href="#">NHA37122</a> (Spanish), <a href="#">NHA37123</a> (Italian), <a href="#">NHA37130</a> (Chinese), <a href="#">NHA37124</a> (Dutch), <a href="#">NHA37126</a> (Polish), <a href="#">NHA37127</a> (Portuguese), <a href="#">NHA37128</a> (Russian), <a href="#">NHA37129</a> (Turkish)
ATV660 Handbook	<a href="#">NHA37111</a> (English), <a href="#">NHA37110</a> (German)
ATV680 Handbook	<a href="#">NHA37113</a> (English), <a href="#">NHA37112</a> (German)
SoMove : FDT	<a href="#">SoMove_FDT</a> (English, French, German, Spanish, Italian, Chinese)
Altivar Process ATV600 : DTM	<a href="#">ATV6xx DTM Library EN</a> (English), <a href="#">ATV6xx DTM Lang FR</a> (French), <a href="#">ATV6xx DTM Lang DE</a> (German), <a href="#">ATV6xx DTM Lang SP</a> (Spanish), <a href="#">ATV6xx DTM Lang IT</a> (Italian), <a href="#">ATV6xx DTM Lang CN</a> (Chinese)

You can download these technical publications and other technical information from our website at <http://download.schneider-electric.com>

## Terminology

The technical terms, terminology, and the corresponding descriptions in this manual normally use the terms or definitions in the relevant standards.

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

Among others, these standards include:

- IEC 61800 series: Adjustable speed electrical power drive systems
- IEC 61508 Ed.2 series: Functional safety of electrical/electronic/programmable electronic safety-related
- EN 954-1 Safety of machinery - Safety related parts of control systems
- EN ISO 13849-1 & 2 Safety of machinery - Safety related parts of control systems.
- IEC 61158 series: Industrial communication networks - Fieldbus specifications
- IEC 61784 series: Industrial communication networks - Profiles
- IEC 60204-1: Safety of machinery - Electrical equipment of machines – Part 1: General requirements

In addition, the term **zone of operation** is used in conjunction with the description of specific hazards, and is defined as it is for a **hazard zone** or **danger zone** in the EC Machinery Directive (2006/42/EC) and in ISO 12100-1.

Also see the glossary at the end of this manual

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# Part II

## Overview

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### What is in This Part?

This section contains the following topics:

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Level Control .....	13
Multi-Pump System Architectures .....	14
Level Control with Analog Sensors.....	15

## Introduction

### About This Application Note

The goal of this Application Note is to provide a commissioning procedure to configure a Multi-Drives Standard Level Control application.

This Application Note does not cover all the use cases and cannot be consider as a substitution of the ATV600 Programming Manual.

For more details about the Level Control function embedded on Altivar Process ATV600 drives, please refer to the ATV600 Programming Manual (EAV64318).

## Level Control

### About Level Control

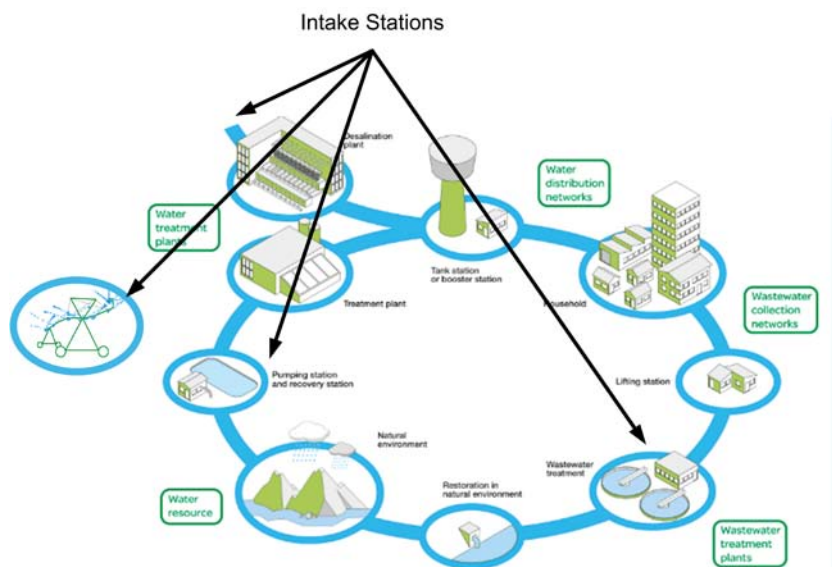
Level Control has a relevant role in process industry. Altivar Process ATV600 drives provide the best energy optimization and monitoring features required for this kind of application.

### Level Control Applications

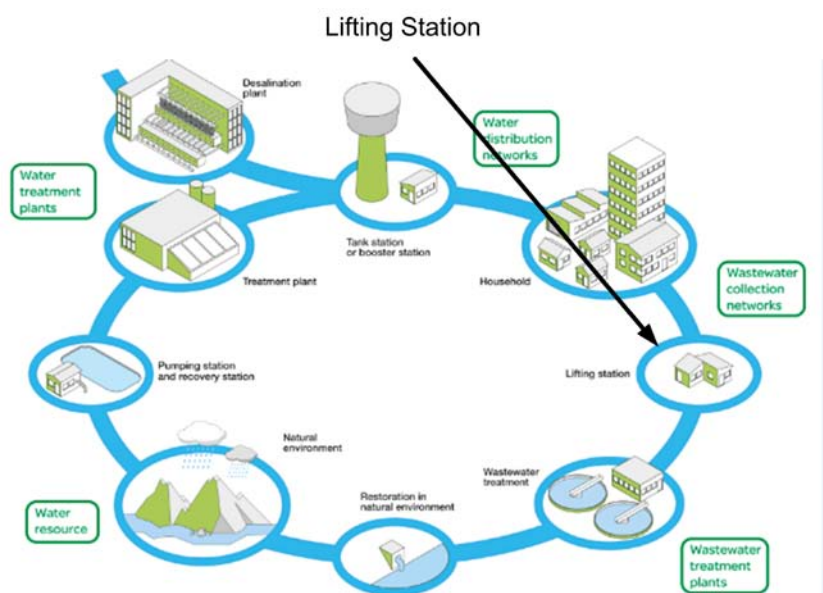
Level Control is used in several pumping processes.

Applications example for Water and Waste Water, where Level Control can be used depending of the Level Control mode:

#### Filling Level Control Process



#### Emptying Level Control Process



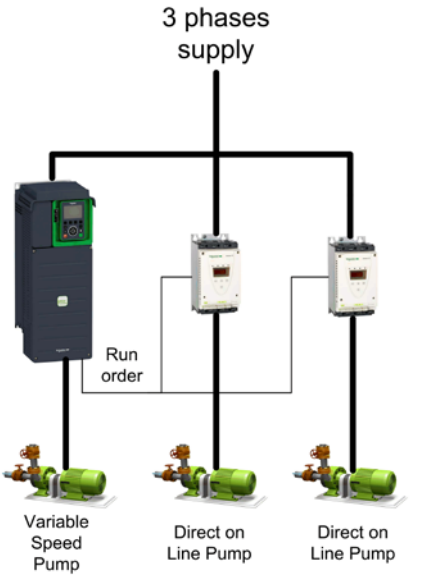
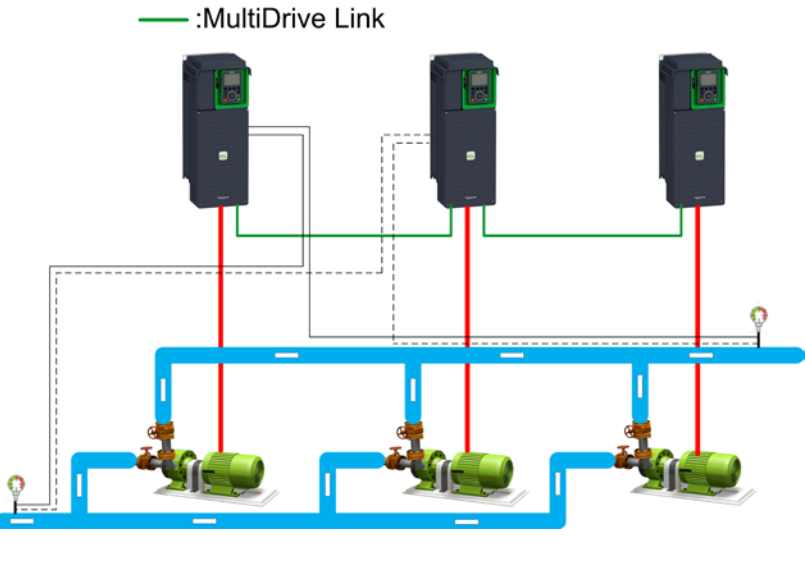
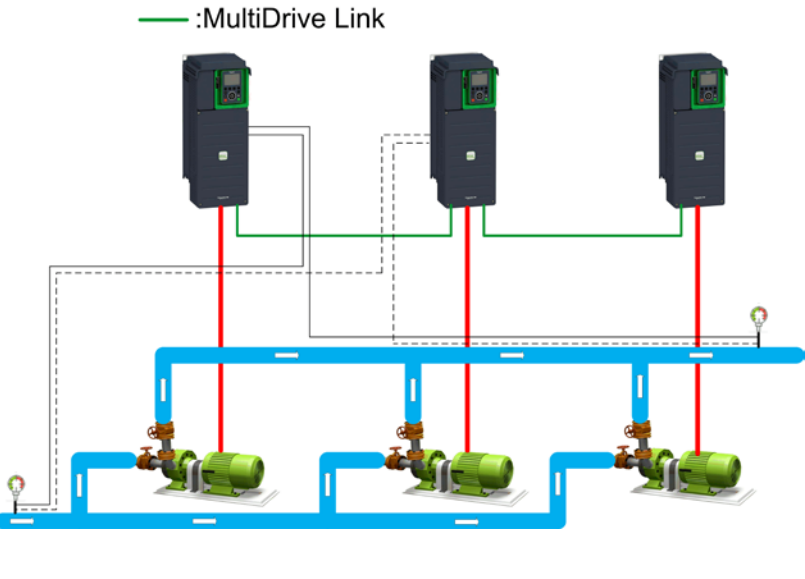
# Multi-Pump System Architectures

## About Multi-Pump System Architectures

Several Multi-Pump System Architectures exist in process industry. Altivar Process ATV600 drives can be used in several architectures.

## Supported Multi-Pump Architectures

The following table shows the Altivar Process ATV600 capabilities for integration into Multi-Pump Architectures:

Single Drive	Multiple Drives	Multiple Drives & Service continuity
 <p>3 phases supply</p> <p>Run order</p> <p>Variable Speed Pump</p> <p>Direct on Line Pump</p> <p>Direct on Line Pump</p>	 <p>:MultiDrive Link</p>	
<p>This architecture can be found on simple installations.</p> <p>It provides basic control of the complete installation with a single drive.</p> <p>The Altivar Process ATV600 drive is able to control up to 5 direct on line (or Starter controlled) pumps in addition to the variable speed one.</p>	<p>This architecture can be found in advanced installations.</p> <p>It provides advanced control of the complete installation including all the variable speed drives.</p> <p>The Master drive can control up to 5 Slaves through Multi-Drive Link technology.</p> <p>In Multiple Drives architecture, sensors are wired to the Master (continuous grey line in the schema)</p> <p><b>NOTE:</b> Altivar Process ATV600 drives must be linked together through a Dual Port Ethernet fieldbus module (VW3A3721) plugged on each Altivar Process ATV600.</p>	<p>This architecture can be found in advanced installations where service continuity is needed.</p> <p>It provides advanced control of the complete installation including all the variable speed drives.</p> <p>The drives on the installation can act as Master, Master or Slave, or Slave only through Multi-Drive Link technology.</p> <p>In Multiple Drives &amp; Service Continuity, sensors are wired to the Master and to the Secondary Master (continuous and dotted grey line).</p> <p><b>NOTE:</b> Altivar Process ATV600 drives must be linked together through a Dual Port Ethernet fieldbus module (VW3A3721) plugged on each Altivar Process ATV600.</p>

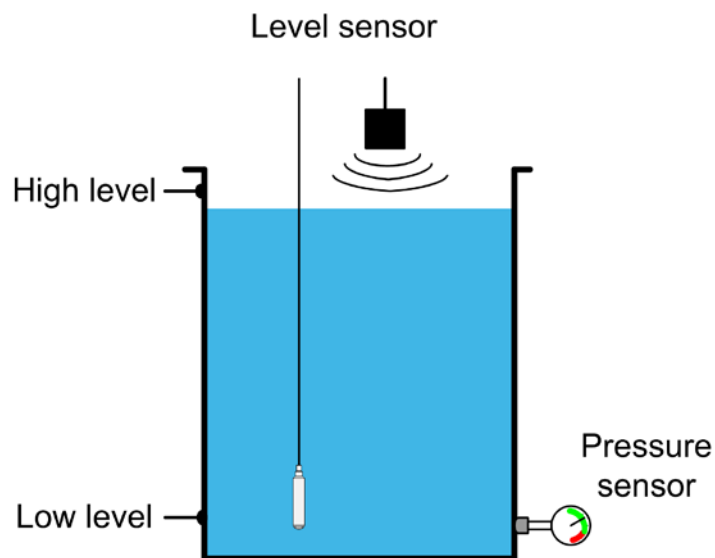
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## Level Control with Analog Sensors

### Strategy Description

With an analog sensor, the starting and stopping pump is based on the comparison between the analog sensor value and configured levels value.

With an analog sensor, Altivar Process ATV600 defines the number of pumps needed to be started and optimal speed in order to reduce the energy consumption.



### Advantages

- Variable speed,
- Possibility to adapt speed according to the height in the tank, in order to optimize energy consumption or the process itself,
- Simple wiring
- Displayed level

# Part III

## Application Description

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**What is in This Part?**

This section contains the following topics:

Application Description.....	17
Wiring.....	18



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## Application Description

### Introduction

This Application Note describes an emptying level control application with 3 Altivar Process ATV600 variable speed drives.

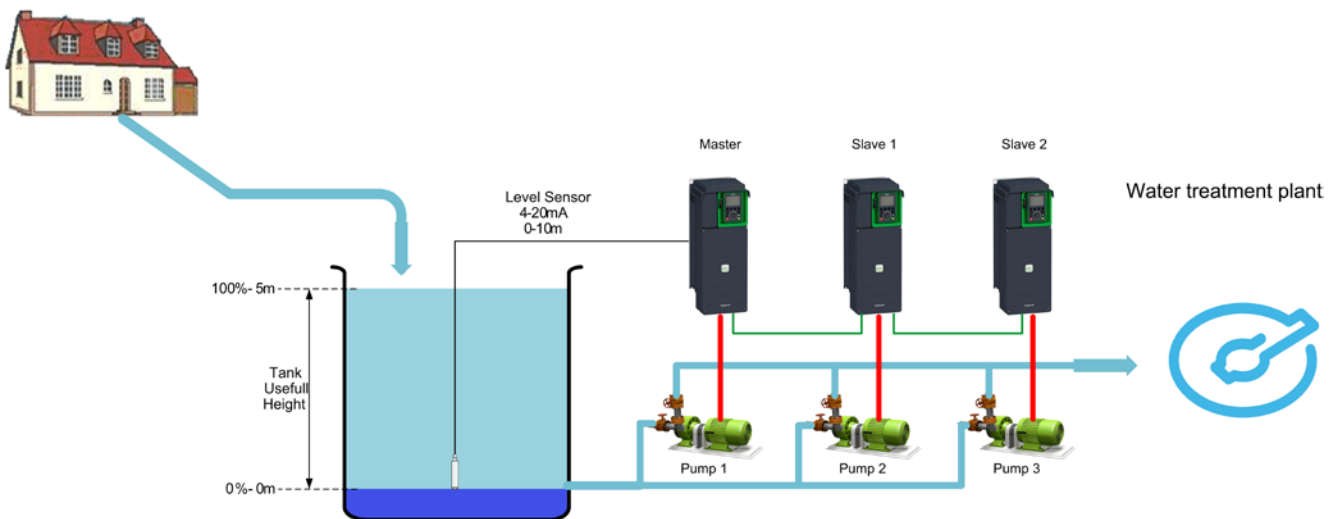
The following parts of this Application Note describe the commissioning procedure for this architecture.

### Application Description

The architecture used as example for this application note is the following:

- A tank with a useful height of 5m.
- 3 Altivar Process ATV600 variable speed drives connected through MultiDrive Link.
- 3 VW3A3721 Ethernet/IP / ModbusTCP fieldbus modules
- 3 Pumps and their associated electrical motors.
- Level sensor (4-20mA, 0-10m)

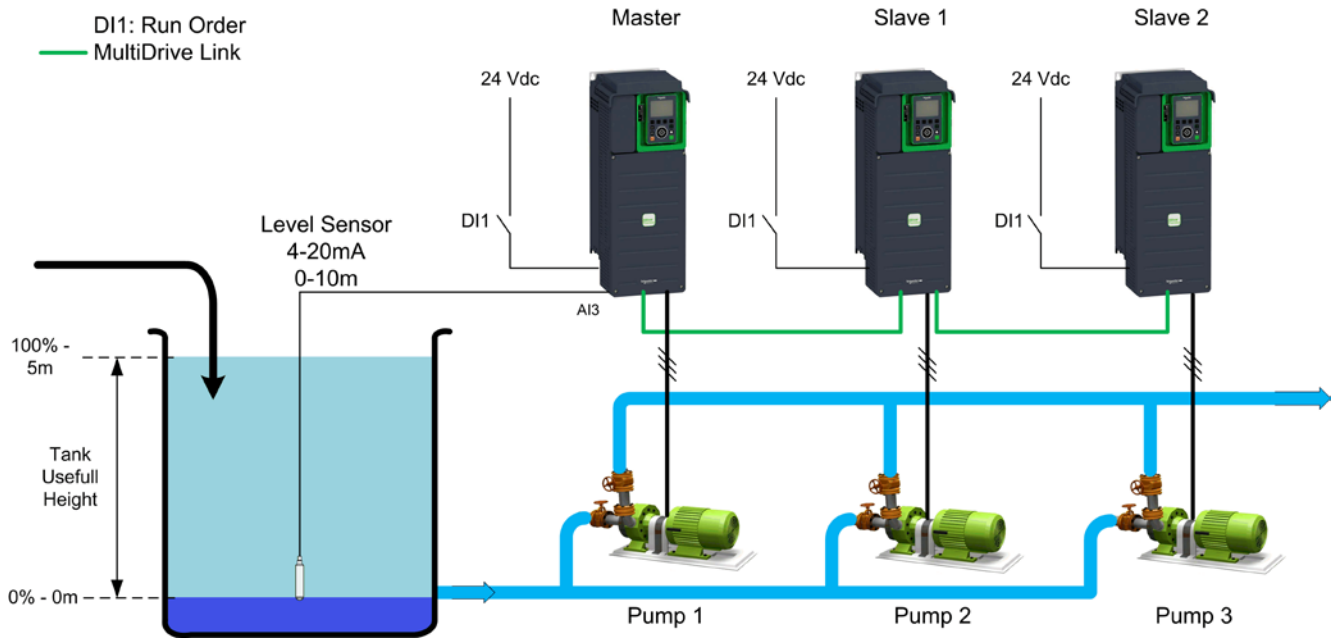
The following figure shows the water architecture used in this application note:



## Wiring

### What is in This Chapter?

The following part of this Application Note describes the wiring procedure for this architecture.



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# Part IV

## Prerequisites

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### Introduction

This part describes the initial steps to do before configuring the Level Control application.

The values of parameters given in this part correspond to the architecture selected for this Application Note.

**NOTE:** Settings may vary according to the architecture needs.

**NOTE:** Before starting the drive configuration, make sure that the drive is reset to factory settings.

### What is in This Part?

This section contains the following topics:

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Motor Configuration .....	21
System Units Customization.....	22
Command and Reference .....	23
Ethernet Settings .....	24

## Application Selection

### Overview

The macro-configuration menu allows you to select the appropriate application functions.

This selection gives access to the dedicated functions and associated parameters.

### Step by Step Configuration

The following table gives the step by step configuration of the application selection parameter:

Step	Action
1	<p>Go to <b>[Complete Settings] C S E</b> → <b>[Macro Configuration] M C r</b> menu</p> <p>The image shows two screenshots of a control interface. The left screenshot shows the 'Main menu' with a wrench icon and a list of options: 2 Dashboard, 3 Diagnostics, 4 Display, 5 Complete settings (highlighted), and 6 Communication. The right screenshot shows the 'Complete settings' menu with options: 5.1 Macro Configuration (highlighted), 5.2 Motor parameters, 5.3 Define system units, 5.4 Sensors Assignment, and 5.5 Command and Refere.. An arrow points from the '5 Complete settings' option in the first screenshot to the '5.1 Macro Configuration' option in the second screenshot.</p>
2	<p>Set <b>[Application Selection] A P P E</b> to <b>[Pump Level Control] L E V E L</b></p> <p>The image shows a screenshot of the 'Application Selection' menu. At the top, it displays 'RDY 0.0Hz 0.00A Term' and a timestamp '11:24'. Below this, the menu title 'Application Selection' is shown. The list of options includes: Generic Pump Control, Pump Level Control (highlighted with a checkmark), Pump Booster Control, and Generic Fan Control.</p>

# Motor Configuration

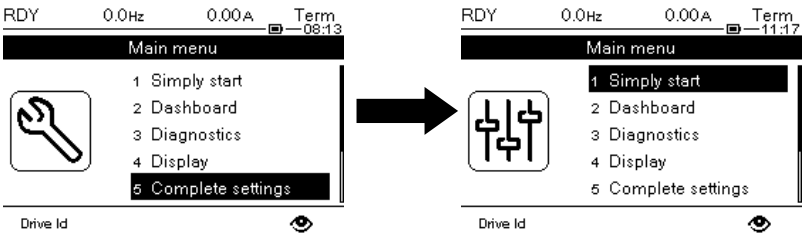
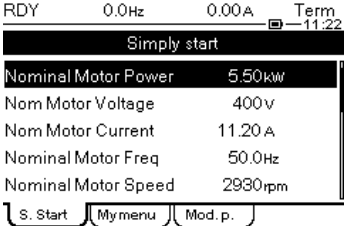
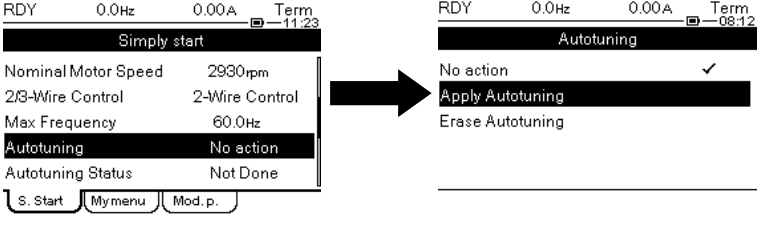
## Overview

The motor parameters must be set to allow optimized motor control performances.

The parameters have to be entered according to the motor nameplate.

## Step by Step Configuration

The following table gives the step by step configuration of the motor parameters:

Step	Action
1	<p>Go to <b>[Complete Settings] C 5 E</b> - menu, <b>[Simply start] S Y S</b> - submenu.</p> 
2	<p>Set the motor parameters according to the motor nameplate:</p> <ul style="list-style-type: none"> <li>• <b>[Motor Standard] b F r</b> : [50 Hz IEC] 50</li> <li>• <b>[Nominal Motor Power] n P r</b> : 5.50 kW</li> <li>• <b>[Nom Motor Voltage] u n S</b> : 400 Vac</li> <li>• <b>[Nom Motor Current] n C r</b> : 11.20 A</li> <li>• <b>[Nominal Motor Freq] F r S</b> : 50.0 Hz</li> <li>• <b>[Nominal Motor Speed] n S P</b> : 2,930 rpm</li> </ul> 
3	<p>Set <b>[Autotuning] E u n</b> to <b>[Apply Autotuning] Y E S</b>.</p> 
4	Verify the good direction if the motor
5	Repeat this procedure for each drives used in the application.

# System Units Customization

## Overview

The Altivar Process ATV600 drive offers the possibility to have customized units for your application.

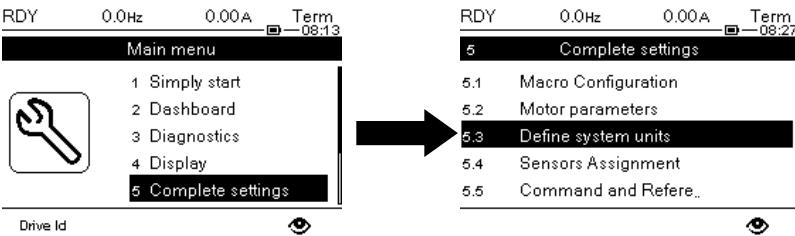
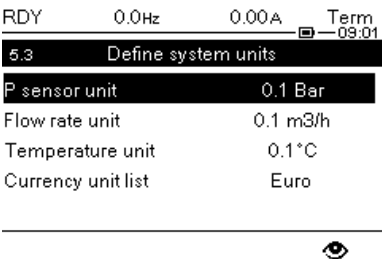
You will have to set your pressure unit according to your application.

This menu is used to customize the following units:

- Pressure
- Flow
- Temperature
- Currency

## Step by Step Configuration

The following table gives the step by step configuration of the system units:

Step	Description
1	<p>Go to <b>[Complete Settings] CSE</b>- menu, <b>[Define system units] SUC</b>- submenu.</p> 
2	<p>Set the following parameters values:</p> <ul style="list-style-type: none"> <li>• <b>[P sensor unit] SUCPr: [0.1 Bar] 01Bar</b></li> <li>• <b>[Flow rate unit] SUCFr: [0.1 m3/h] 01m3h</b></li> <li>• <b>[Temperature unit] SUCtP: [0.1°C] 01C</b></li> <li>• <b>[Currency unit list] SUCu: [Euro] Euro</b></li> </ul> 

## Command and Reference

### Overview

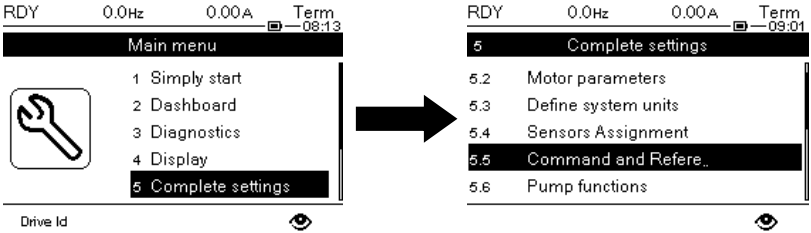
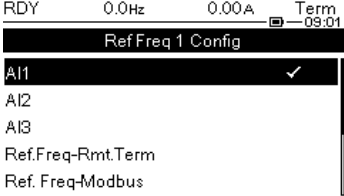
The Altivar Process ATV600 drive offers several command and reference channels.

This menu is used to customize these channels according to the application needs.

In this Application Note, we use the factory setting configuration of Altivar Process ATV600: the command and reference value come from terminals.

### Step by Step Configuration

The following table gives the step by step configuration of the command and reference value parameters:

Step	Action
1	<p>Go to <b>[Complete Settings] C S E</b> - menu, <b>[Command and Reference] C R P</b> - submenu.</p> 
2	<p>Set <b>[Ref Freq 1 Config] F r 1</b> to <b>[AI1] A 1</b>.</p> 
3	Repeat this procedure for each drives used in the application.

# Ethernet Settings

## Overview

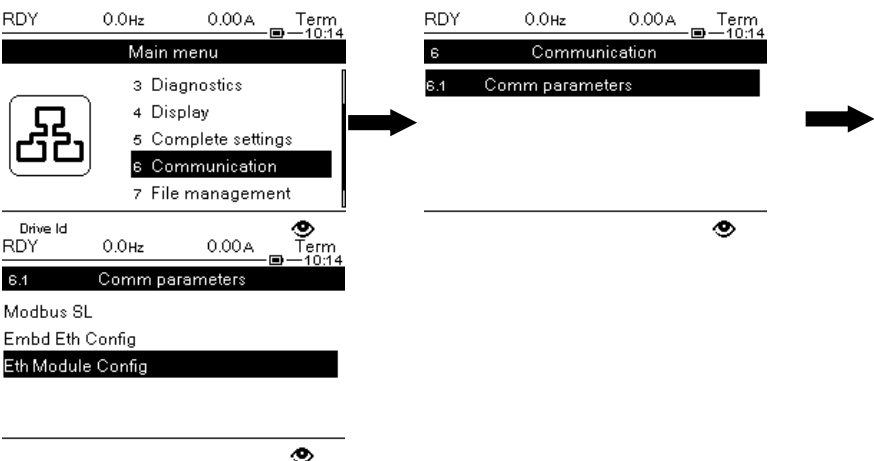
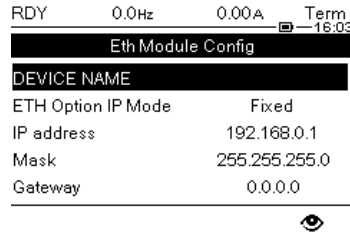
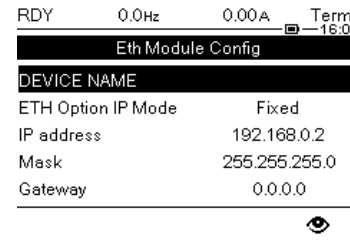
MultiDrive Link feature of Altivar Process ATV600, equipped with VW3A3721 Ethernet modules, allows controlling all the drives of your application using an Ethernet link between your drives.

All the drives of an application have to be on the same Ethernet network.

**NOTE:** The Ethernet settings configuration can also be done automatically using a DHCP or a BOOTP server like a PLC.

## Step by Step Configuration

The following table gives the step by step configuration for the Ethernet settings:

Step	Action
1	<p>Go to <b>[Communication]</b> <math>\leftarrow \leftarrow \leftarrow</math> <b>[Comm parameters]</b> <math>\leftarrow \leftarrow \leftarrow</math> <b>[Eth Module Config]</b> <math>\leftarrow \leftarrow \leftarrow</math> menu</p>  <p>The diagram shows a sequence of three screenshots. The first is the 'Main menu' with options: 3 Diagnostics, 4 Display, 5 Complete settings, 6 Communication, 7 File management. An arrow points to the second screenshot, '6 Communication', with sub-option '6.1 Comm parameters'. A second arrow points to the third screenshot, '6.1 Comm parameters', with sub-option 'Eth Module Config'. The top status bar in all screenshots shows 'RDY 0.0Hz 0.00A Term 10:14'.</p>
2	<p>On drive 1, configure the Ethernet settings:</p> <ul style="list-style-type: none"> <li>• Set <b>[ETH Option IP Mode]</b> , <math>\leftarrow \leftarrow \leftarrow</math> to <b>[Fixed]</b> <math>\leftarrow \leftarrow \leftarrow</math>,</li> <li>• Set <b>[IP address]</b> to 192.168.0.1</li> <li>• Set <b>[Mask]</b> to 255.255.255.0</li> <li>• Set <b>[Gateway]</b> to 0.0.0.0</li> </ul>  <p>The screenshot shows the 'Eth Module Config' screen for Drive 1. The top status bar shows 'RDY 0.0Hz 0.00A Term 16:03'. The screen displays: 'DEVICE NAME', 'ETH Option IP Mode Fixed', 'IP address 192.168.0.1', 'Mask 255.255.255.0', and 'Gateway 0.0.0.0'. A 'Term' icon is visible at the bottom right.</p>
3	<p>On drive 2, configure the Ethernet settings:</p> <ul style="list-style-type: none"> <li>• Set <b>[ETH Option IP Mode]</b> , <math>\leftarrow \leftarrow \leftarrow</math> to <b>[Fixed]</b> <math>\leftarrow \leftarrow \leftarrow</math>,</li> <li>• Set <b>[IP address]</b> to 192.168.0.2</li> <li>• Set <b>[Mask]</b> to 255.255.255.0</li> <li>• Set <b>[Gateway]</b> to 0.0.0.0</li> </ul>  <p>The screenshot shows the 'Eth Module Config' screen for Drive 2. The top status bar shows 'RDY 0.0Hz 0.00A Term 16:03'. The screen displays: 'DEVICE NAME', 'ETH Option IP Mode Fixed', 'IP address 192.168.0.2', 'Mask 255.255.255.0', and 'Gateway 0.0.0.0'. A 'Term' icon is visible at the bottom right.</p>



Step	Action
4	<p data-bbox="502 235 965 264">On drive 3, configure the Ethernet settings:</p> <ul data-bbox="502 302 949 465" style="list-style-type: none"> <li data-bbox="502 302 949 358">• Set <b>[ETH Option IP Mode]</b> to <b>[Fixed]</b></li> <li data-bbox="502 369 949 403">• Set <b>[IP address]</b> to 192.168.0.3</li> <li data-bbox="502 414 949 448">• Set <b>[Mask]</b> to 255.255.255.0</li> <li data-bbox="502 459 949 492">• Set <b>[Gateway]</b> to 0.0.0.0</li> </ul> <div data-bbox="1037 226 1388 465" style="border: 1px solid black; padding: 5px;"> <p data-bbox="1045 235 1380 257">RDY 0.0Hz 0.00A Term 16:04</p> <p data-bbox="1045 264 1380 291" style="background-color: black; color: white; text-align: center;">Eth Module Config</p> <p data-bbox="1045 297 1380 324" style="background-color: black; color: white; text-align: center;">DEVICE NAME</p> <p data-bbox="1045 331 1380 353">ETH Option IP Mode Fixed</p> <p data-bbox="1045 360 1380 383">IP address 192.168.0.3</p> <p data-bbox="1045 389 1380 412">Mask 255.255.255.0</p> <p data-bbox="1045 418 1380 441">Gateway 0.0.0.0</p> <p data-bbox="1332 443 1364 465" style="text-align: right;">👁</p> </div>
5	Restart the drives to take into account the Ethernet settings.

# Part V

## MultiPump Configuration

---

### Introduction

This part describes the steps to do in order to use the MultiDrive Link feature of Altivar Process ATV600.

The values of parameters given in this part correspond to the Multi Drives architecture selected for this Application Note.

**NOTE:** Settings may vary according to the architecture needs.

### What is in This Part?

This section contains the following topics:

Pump System Architectures.....	27
MultiDrive Link Configuration .....	28

# Pump System Architectures

## Overview

The Altivar Process ATV600 drive can be used in several pumps architectures.

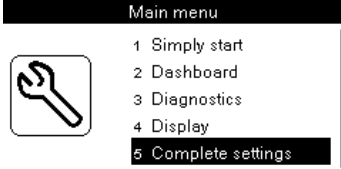
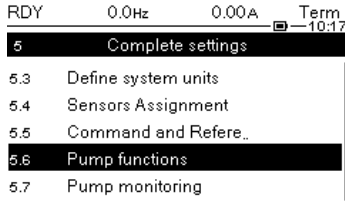
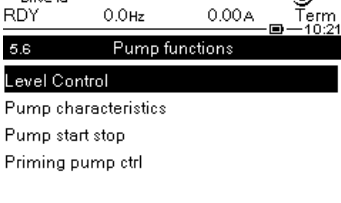
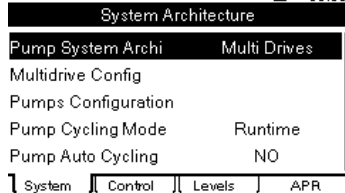
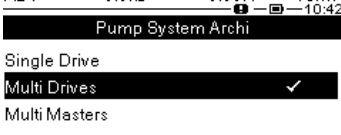
This menu is used to select and configure one of the following architectures:

- Single Drive: one Altivar Process ATV600 and up to 6 fixed speed pumps.
- Multi Drives: one master Altivar Process ATV600 and up to 6 slaves Altivar Process ATV600.
- Multi Masters: one master Altivar Process ATV600 and up to 6 Altivar Process ATV600 that can acts as masters or slaves.

In this Application Note, the selected architecture is Multi Drives.

## Steps by Step Configuration

The following table gives the steps by step configuration for the selection of Pump System Architecture:

Step	Action
1	<p>Go to <b>[Complete settings] C S L → [Pump functions] P F L → [Level control] L V L → [System architecture] P P 9</b> menu</p>    
2	<p>Set <b>[Pump System Architecture] P P 5 A</b> to <b>[Multi Drives] n V 5 d</b></p> 

# MultiDrive Link Configuration

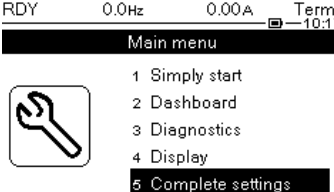
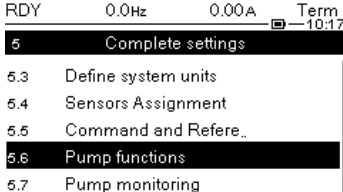
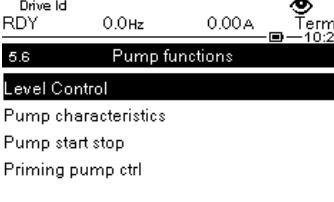
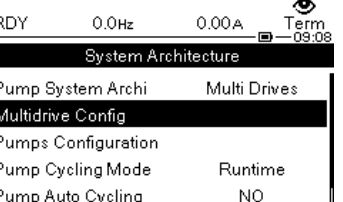
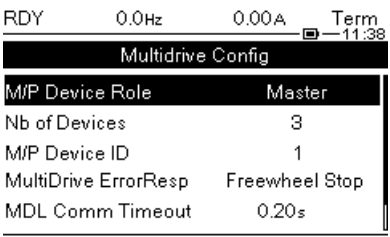
## Overview

The MultiDrive Link needs to be configured on each drives to define if the devices in the application acts as Master or Slave.

In this Application Note, one drive acts as Master and two drives act as Slaves.

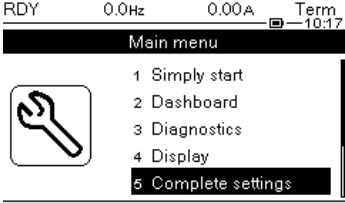
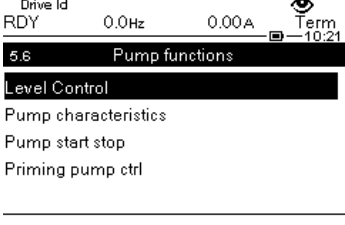
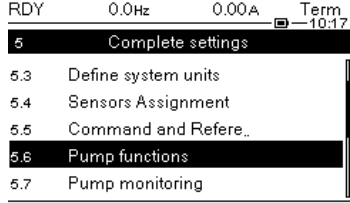
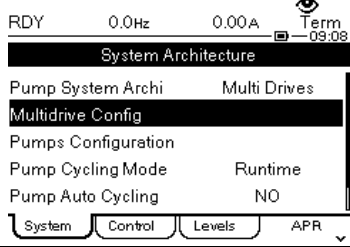
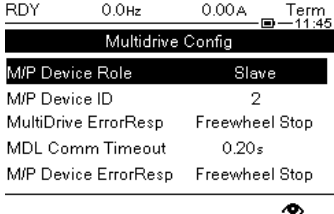
## Master Step by Step Configuration

The following table gives the step by step configuration of the MultiDrive Link Master.

Step	Action
1	<p>Go to <b>[Complete settings] C S E → [Pump functions] P F E → [Level control] L V L → [System architecture] P P 9 → [Multidrive Config] P P V C</b> menu</p>    
2	<p>Configure the parameters:</p> <ul style="list-style-type: none"> <li>• Set <b>[M/P Device Role] P P D E</b> to <b>[Master] P P S E</b>,</li> <li>• Set <b>[Nb of Devices] P P G n</b> to 3,</li> <li>• Set <b>[M/P Device ID] P P G , d</b> to 1</li> </ul> 

## Slaves Step by Step Configuration

The following table gives the step by step configuration of the MultiDrive Link Slaves:

Step	Action
1	<p>Go to <b>[Complete settings] C S E</b> → <b>[Pump functions] P F E</b> → <b>[Level control] L V L</b> → <b>[System architecture] P P 9</b> → <b>[Multidrive Config] P P V C</b> menu</p>    
2	<p>Configure the parameters:</p> <ul style="list-style-type: none"> <li>• Set <b>[M/P Device Role] P P d E</b> to <b>[Slave] S L A V E</b>,</li> <li>• Set <b>[M/P Device ID] P G , d</b> to 2</li> </ul> 
3	<p>Repeat the operation on the other slaves by incrementing the <b>[M/P Device ID] P G , d</b> value.</p>

# Part VI

## Level Control Configuration

---

### Introduction

This part describes the steps to do in order to configure the Level Control application.

The values of parameters given in this part correspond to the architecture selected for this Application Note.

**NOTE:** Settings may vary according to the architecture needs.

### What is in This Part?

This section contains the following topics:

Level Control Mode Selection .....	31
Sensor Configuration .....	32
Tank Height Configuration .....	34
Start / Stop Levels.....	35
Start the Application.....	37

## Level Control Mode Selection

### Overview

Two Level Control mode selections can be selected on Altivar Process ATV600, filling or emptying mode.

In this Application Note, the Level Control mode selected is emptying.

### Step by Step Configuration

The following table gives the step by step configuration of the Level Control mode selection.

Step	Action
1	<p>On master go to <b>[Complete settings] C S E</b> → <b>[Pump functions] P F E</b> → <b>[Level control] L V L</b> menu → <b>[Level Control] L C C</b> tab:</p> <p>RDY 0.0Hz 0.00A Term -10:17</p> <p>Main menu</p> <ul style="list-style-type: none"> <li>1 Simply start</li> <li>2 Dashboard</li> <li>3 Diagnostics</li> <li>4 Display</li> <li>5 Complete settings</li> </ul> <p>RDY 0.0Hz 0.00A Term -10:17</p> <p>5 Complete settings</p> <ul style="list-style-type: none"> <li>5.3 Define system units</li> <li>5.4 Sensors Assignment</li> <li>5.5 Command and Refere..</li> <li>5.6 Pump functions</li> <li>5.7 Pump monitoring</li> </ul> <p>RDY 0.0Hz 0.00A Term -10:21</p> <p>5.6 Pump functions</p> <p>Level Control</p> <p>Pump characteristics</p> <p>Pump start stop</p> <p>Priming pump ctrl</p> <p>RDY 0.0Hz 0.00A Term -11:02</p> <p>Level Control</p> <p>LevelCtrl Mode No</p> <p>System Control Levels APR</p>
2	<p>Set <b>[LevelCtrl Mode] L C N</b> to <b>[Emptying] E N P E Y</b>:</p> <p>RDY 0.0Hz 0.00A Term -11:32</p> <p>LevelCtrl Mode</p> <p>No</p> <p>Filling</p> <p>Emptying ✓</p>

## Sensor Configuration

### Overview

Altivar Process ATV600 drive supports three sensor types to manage the tank level in a Level Control application:

- Level switches
- Level sensor
- Pressure sensor

In this Application Note, the sensor used is a Level Sensor with following specifications: 4-20mA for 0-10m.

### Sensor Type

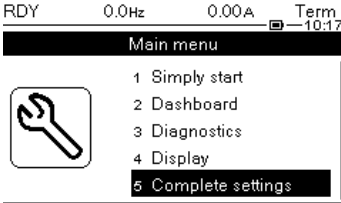
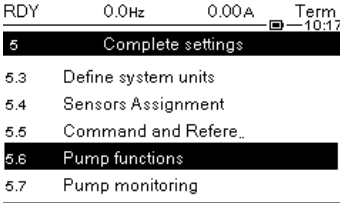
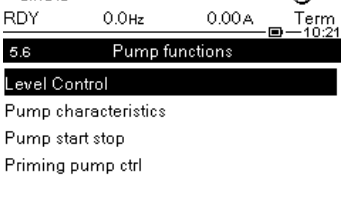
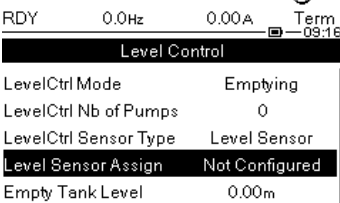
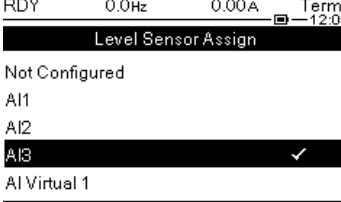
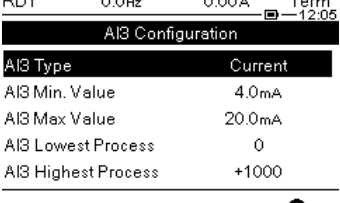
Configure the sensor type as below:

Step	Action
1	<p>On Master go to <b>[Complete settings] C 5 E</b> → <b>[Pump functions] P F E</b> → <b>[Level control] L V L</b> menu → <b>[Level Control] L C C</b> tab</p> <p>The sequence of screenshots shows the navigation path: Main menu (5 Complete settings) → Complete settings (5.6 Pump functions) → Pump functions (Level Control) → Level Control configuration (LevelCtrl Sensor Type: Level Sensor).</p>
2	<p>Set <b>[LevelCtrl Sensor Type] L C E n</b> to <b>[Level Sensor] L E V E L</b>.</p> <p>The screenshot shows the 'LevelCtrl Sensor Type' configuration screen with 'Level Sensor' selected and a checkmark.</p>



## Sensor Assignment and Configuration

The following table gives the step by step configuration of the sensor used:

Step	Action
1	<p>On master go to <b>[Complete settings] C 5 E</b> → <b>[Pump functions] P F E</b> menu → <b>[Level control] L V L</b> → <b>[Level Control] L C C</b> tab</p>    
2	<p>Set <b>[Level Sensor Assign]</b> to <b>[AI3]</b></p> 
3	<p>In <b>[AI1 Configuration] L C H I</b> configure the following parameters:</p> <ul style="list-style-type: none"> <li>• Set <b>[AI3 Type] H , 3 E</b> to <b>[Current] D H</b>,</li> <li>• Set <b>[AI3 Min. Value] C r L 3</b> to 4.0 mA,</li> <li>• Set <b>[AI3 Max Value] C r H 3</b> to 20 mA,</li> <li>• Set <b>[AI3 Lowest Process] H , 3 J</b> to 0,</li> <li>• Set <b>[AI3 Highest Process] H , 3 K</b> to 1000.</li> </ul>  <p><b>NOTE:</b> The lowest and highest process values entered correspond to the minimum and maximum values of the sensor. As the sensor type used is a level sensor, the unit here is in 0.01m.</p>

# Tank Height Configuration

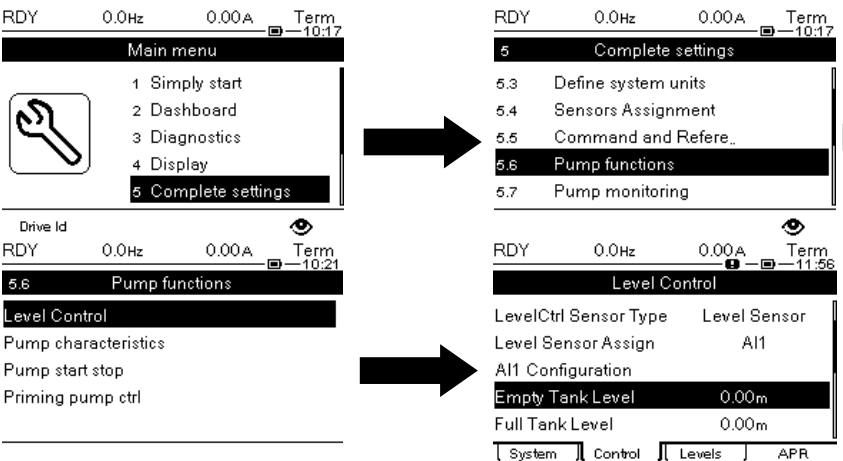
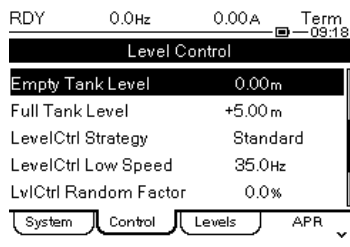
## Overview

The tank height configuration has to be configured to make relation between the sensor configuration and the real tank height.

In this Application Note, the tank height is 5m which is lower than the maximum value of the level sensor used.

## Step by Step Configuration

The following table gives the step by step configuration of the tank height configuration:

Step	Action
1	<p>On master go to <b>[Complete settings] L 5 E</b> → <b>[Pump functions] P F E</b> → <b>[Level control] L V L</b> menu → <b>[Level Control] L L C</b> tab</p> 
2	<p>Configure the height of the tank:</p> <ul style="list-style-type: none"> <li>• Set <b>[Empty Tank Level] L L E J</b> to 0.00 m,</li> <li>• Set <b>[Full Tank Level] L L E K</b> to 5.00 m.</li> </ul> 

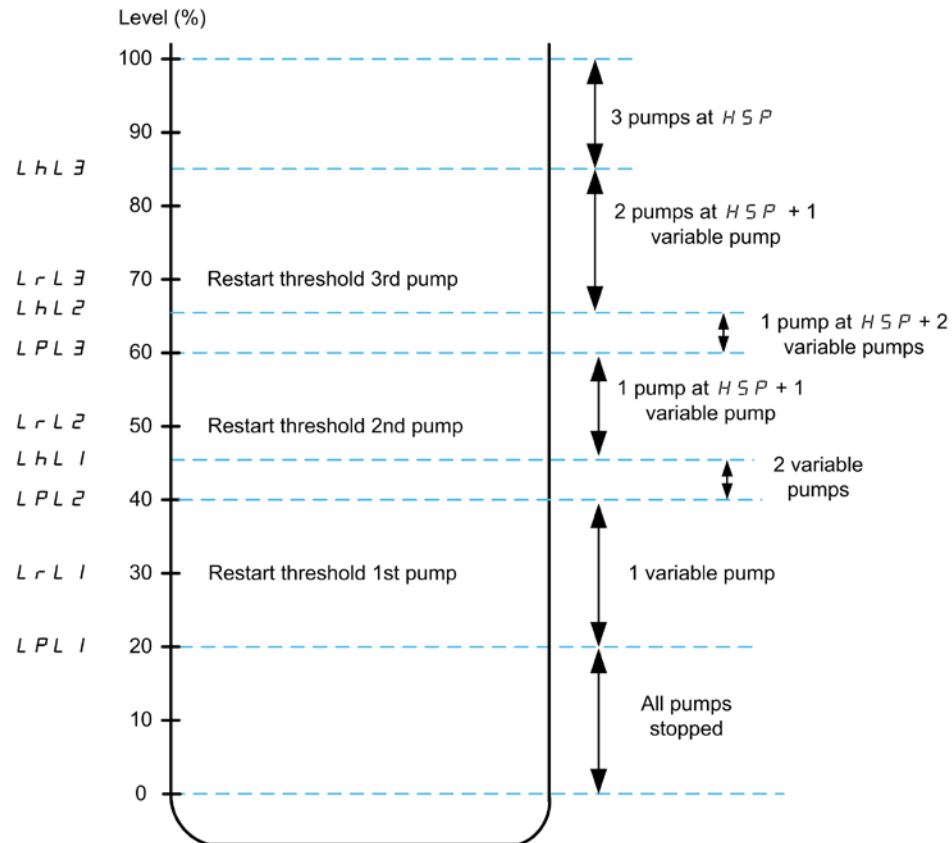
## Start / Stop Levels

### Overview

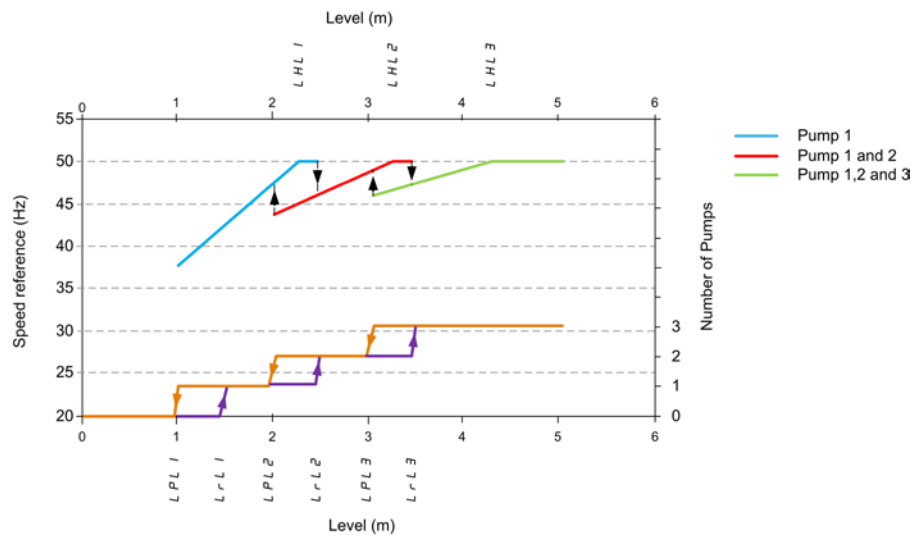
In order to use the Level Control function, it is needed to configure the start and stop levels of each pumps used in the application.

In this Application Note, the levels have been defined as follow:

#### Speed according to the level



#### Speed and number of pumps according to the level



## Steps by Step Configuration

The following table gives the steps by step configuration for the Start / Stop levels:

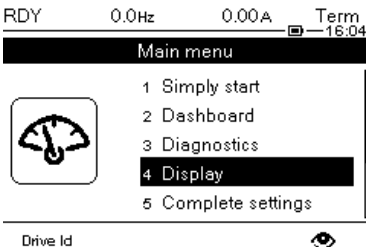
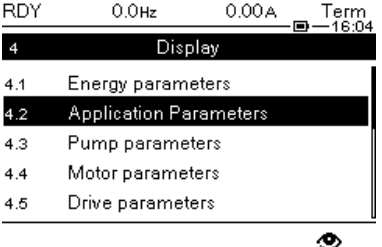
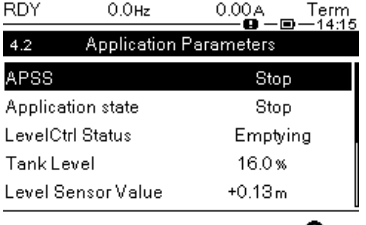
Step	Action
1	<p>On Master, go to <b>[Complete settings] C S E</b> → <b>[Pump functions] P F E</b> → <b>[Level control] L V L</b> menu → <b>[Level] L C C</b> tab</p>
2	<p>Configure the start / stop level for the 1<sup>st</sup> pump:</p> <ul style="list-style-type: none"> <li>• Set <b>[Level 1st Pump Start] L r L 1</b> to 30.0%,</li> <li>• Set <b>[Level 1st Pump Stop] L P L 1</b> to 20.0%,</li> <li>• Set <b>[Level 1st Pump HSP] L H L 1</b> to 45.0%.</li> </ul>
3	<p>Configure the start / stop level for the 2<sup>nd</sup> pump:</p> <ul style="list-style-type: none"> <li>• Set <b>[Level 2nd Pump Start] L r L 2</b> to 50.0%,</li> <li>• Set <b>[Level 2nd Pump Stop] L P L 2</b> to 40.0%,</li> <li>• Set <b>[Level 2nd Pump HSP] L H L 2</b> to 65.0%.</li> </ul>
4	<p>Configure the start / stop level for the 3<sup>rd</sup> pump:</p> <ul style="list-style-type: none"> <li>• Set <b>[Level 3rd Pump Start] L r L 3</b> to 70.0%,</li> <li>• Set <b>[Level 3rd Pump Stop] L P L 3</b> to 60.0%,</li> <li>• Set <b>[Level 3rd Pump HSP] L H L 3</b> to 85.0%.</li> </ul>

## Start the Application

### Check the Application

Before starting the application, you have to check the parameters configuration in the Display menu.

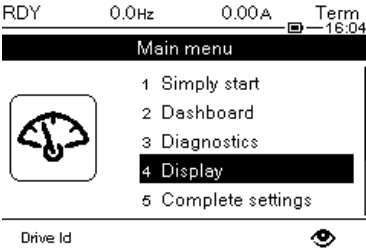
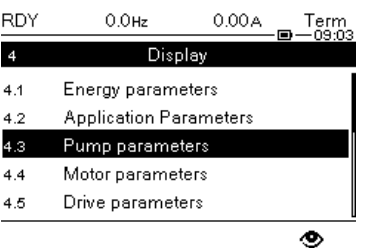
The following table gives the step by step configuration to check the application:

Step	Action												
1	<p>On Master, go to <b>[Display] <i>Π ο η</i></b> → <b>[Application Parameters] <i>Α Ρ Ρ</i></b> menu</p>  												
2	<p>Check the state of the following parameters:</p>  <table border="1" data-bbox="730 1102 1465 1608"> <thead> <tr> <th>Setting</th> <th>Verify that...</th> </tr> </thead> <tbody> <tr> <td><b>[System App State] <i>Α Ρ Σ Σ</i></b></td> <td>The state is <b>[Stop]</b>. No run order on Master or Slaves</td> </tr> <tr> <td><b>[Application state] <i>Α Ρ Ρ Σ</i></b></td> <td>The state is <b>[Stop]</b>. No run order on the current device.</td> </tr> <tr> <td><b>[LevelCtrl Status] <i>Λ C Σ</i></b></td> <td>The state is consistent according to the tank level: <ul style="list-style-type: none"> <li>• <b>[Emptying]</b> : level between high and low value</li> <li>• <b>[Low Level]</b> : Empty tank</li> <li>• <b>[High Level]</b> : Full tank</li> </ul> </td> </tr> <tr> <td><b>[Tank Level] <i>Λ C Λ Λ</i></b></td> <td>The level is consistent according to the tank level.</td> </tr> <tr> <td><b>[Level Sensor Value] <i>Λ C Σ V</i></b></td> <td>The value is consistent.</td> </tr> </tbody> </table>	Setting	Verify that...	<b>[System App State] <i>Α Ρ Σ Σ</i></b>	The state is <b>[Stop]</b> . No run order on Master or Slaves	<b>[Application state] <i>Α Ρ Ρ Σ</i></b>	The state is <b>[Stop]</b> . No run order on the current device.	<b>[LevelCtrl Status] <i>Λ C Σ</i></b>	The state is consistent according to the tank level: <ul style="list-style-type: none"> <li>• <b>[Emptying]</b> : level between high and low value</li> <li>• <b>[Low Level]</b> : Empty tank</li> <li>• <b>[High Level]</b> : Full tank</li> </ul>	<b>[Tank Level] <i>Λ C Λ Λ</i></b>	The level is consistent according to the tank level.	<b>[Level Sensor Value] <i>Λ C Σ V</i></b>	The value is consistent.
Setting	Verify that...												
<b>[System App State] <i>Α Ρ Σ Σ</i></b>	The state is <b>[Stop]</b> . No run order on Master or Slaves												
<b>[Application state] <i>Α Ρ Ρ Σ</i></b>	The state is <b>[Stop]</b> . No run order on the current device.												
<b>[LevelCtrl Status] <i>Λ C Σ</i></b>	The state is consistent according to the tank level: <ul style="list-style-type: none"> <li>• <b>[Emptying]</b> : level between high and low value</li> <li>• <b>[Low Level]</b> : Empty tank</li> <li>• <b>[High Level]</b> : Full tank</li> </ul>												
<b>[Tank Level] <i>Λ C Λ Λ</i></b>	The level is consistent according to the tank level.												
<b>[Level Sensor Value] <i>Λ C Σ V</i></b>	The value is consistent.												

**Check the Pump Parameters**

Before starting the application, you have to check the parameters configuration in the Display menu.

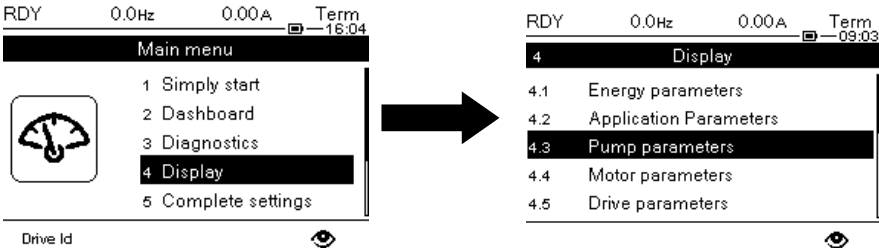
The following table gives the step by step configuration to check the pump parameters:

Step	Action																				
1	<p>On Master, go to <b>[Display] ΠΠΠ</b> → <b>[Pump parameters] ΠΠΠ</b> menu <b>[Multipump System] ΠΠΠ</b> tab</p>  																				
2	On Slave 1 and Slave 2, give a run order.																				
3	<p>Check the state of the following parameters:</p> <table border="1" data-bbox="694 817 1428 1467"> <thead> <tr> <th>Setting</th> <th>Verify that...</th> </tr> </thead> <tbody> <tr> <td><b>[MultiPump State]</b> ΠΠΠ</td> <td>The state is <b>[Ready]</b></td> </tr> <tr> <td><b>[Available Pumps]</b> ΠΠΠΠ</td> <td>The number of available pumps is <b>3</b></td> </tr> <tr> <td><b>[Number of Staged Pump]</b> ΠΠΠΠ</td> <td>There is no staged pump</td> </tr> <tr> <td><b>[Pump 1 State]</b> Π ΠΠ</td> <td>The state is <b>[Ready]</b></td> </tr> <tr> <td><b>[Pump 1 Type]</b> Π ΠΠ</td> <td>The state is <b>[Auxiliary Variable]</b></td> </tr> <tr> <td><b>[Pump 2 State]</b> Π ΠΠ</td> <td>The state is <b>[Ready]</b></td> </tr> <tr> <td><b>[Pump 2 Type]</b> Π ΠΠ</td> <td>The state is <b>[Auxiliary Variable]</b></td> </tr> <tr> <td><b>[Pump 3 State]</b> Π ΠΠ</td> <td>The state is <b>[Ready]</b></td> </tr> <tr> <td><b>[Pump 3 Type]</b> Π ΠΠ</td> <td>The state is <b>[Auxiliary Variable]</b></td> </tr> </tbody> </table>	Setting	Verify that...	<b>[MultiPump State]</b> ΠΠΠ	The state is <b>[Ready]</b>	<b>[Available Pumps]</b> ΠΠΠΠ	The number of available pumps is <b>3</b>	<b>[Number of Staged Pump]</b> ΠΠΠΠ	There is no staged pump	<b>[Pump 1 State]</b> Π ΠΠ	The state is <b>[Ready]</b>	<b>[Pump 1 Type]</b> Π ΠΠ	The state is <b>[Auxiliary Variable]</b>	<b>[Pump 2 State]</b> Π ΠΠ	The state is <b>[Ready]</b>	<b>[Pump 2 Type]</b> Π ΠΠ	The state is <b>[Auxiliary Variable]</b>	<b>[Pump 3 State]</b> Π ΠΠ	The state is <b>[Ready]</b>	<b>[Pump 3 Type]</b> Π ΠΠ	The state is <b>[Auxiliary Variable]</b>
Setting	Verify that...																				
<b>[MultiPump State]</b> ΠΠΠ	The state is <b>[Ready]</b>																				
<b>[Available Pumps]</b> ΠΠΠΠ	The number of available pumps is <b>3</b>																				
<b>[Number of Staged Pump]</b> ΠΠΠΠ	There is no staged pump																				
<b>[Pump 1 State]</b> Π ΠΠ	The state is <b>[Ready]</b>																				
<b>[Pump 1 Type]</b> Π ΠΠ	The state is <b>[Auxiliary Variable]</b>																				
<b>[Pump 2 State]</b> Π ΠΠ	The state is <b>[Ready]</b>																				
<b>[Pump 2 Type]</b> Π ΠΠ	The state is <b>[Auxiliary Variable]</b>																				
<b>[Pump 3 State]</b> Π ΠΠ	The state is <b>[Ready]</b>																				
<b>[Pump 3 Type]</b> Π ΠΠ	The state is <b>[Auxiliary Variable]</b>																				

## Start the Drives

Once the checking of the application is done, you can start the application

The following table gives the step by step configuration to start the drives:

Step	Action
1	On Master, give the run order
2	On Master, go to <b>[Display] Π Π Π</b> → <b>[Pump parameters] P P r</b> menu <b>[Multipump System] Π Π 5</b> tab 
3	Check that <b>[MultiPump State] Π Π 5</b> state is set to <b>[Running] r u n</b>
4	Perform a cycle to check that the pumps start and stop at the expected levels using the <b>[Application Parameters] A P r</b> and <b>[Multipump System] Π Π 5</b> menus
<b>NOTE:</b> It is possible to use the Display tab in the Webserver.	

# Part VII

## Additional Parameters

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### Introduction

This part describes the additional steps that can be achieved to optimize the Level Control application behavior.

In factory settings configuration, these parameters allow standard working on the application.

The values of parameters given in this part are given as example with their effects on the application.

**NOTE:** Settings may vary according to the architecture needs.

### What is in This Part?

This section contains the following topics:

MultiDrive Link – Errors & Warning Handling .....	41
System Architecture – Pumps Configuration.....	44
System Architecture – Pump Cycling Parameters .....	45
Level Control – Number of Pumps .....	46
Level Control – Random Factor .....	47
Level Control – Error & Warning Handling .....	48



## MultiDrive Link – Errors & Warning Handling

### Overview

It is possible to configure the response to errors of the drives can detect on the MultiDrive Link architecture.

It is also possible to configure the MultiDrive Link communication timeout according to the network load of the application.

By default, these error responses are set to ramp stop to avoid water hammer effect.

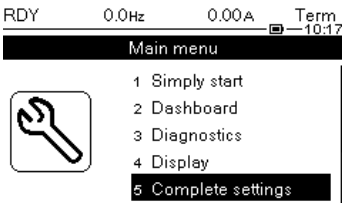
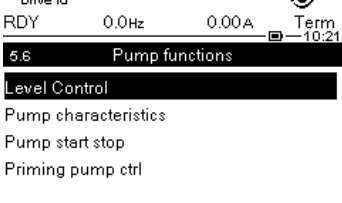
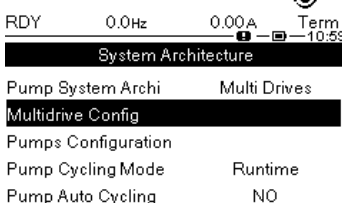
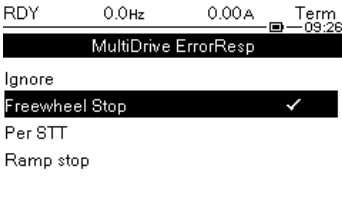
In this configuration example, the error responses are changed to freewheel stop and the timeout is set to 0.20s.

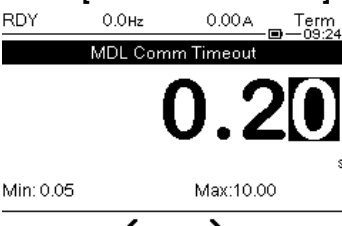
A **[MultiDrive Link Error]  $\Pi d L F$**  error is active if the MultiDrive Link architecture is not consistent (several Masters, several Slaves with same ID) at run command. The drive response to a **[MultiDrive Link Error]  $\Pi d L F$**  is set with **[MultiDrive ErrorResp]  $\Pi d L b$**  parameter.

The **[M/P Device Error]  $\Pi P d F$**  error can be active only on a device which acts as a Slave. The drive response to a **[M/P Device Error]  $\Pi P d F$**  is set with **[M/P Device ErrorResp]  $\Pi P d b$**  parameter.

### Master Configuration

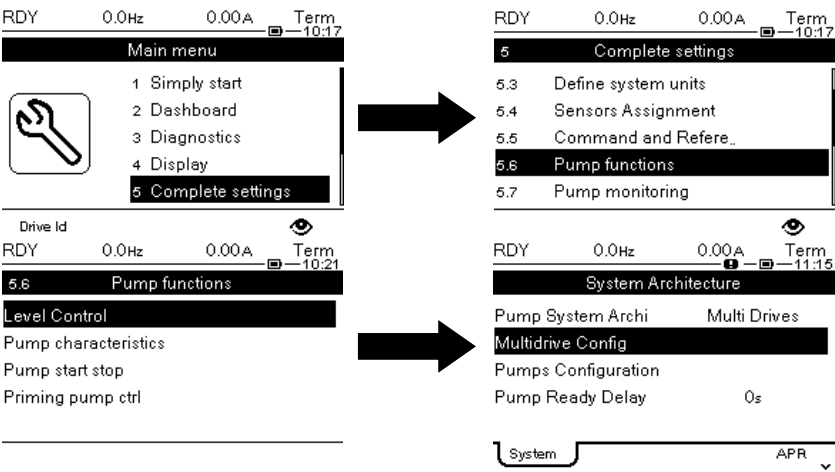
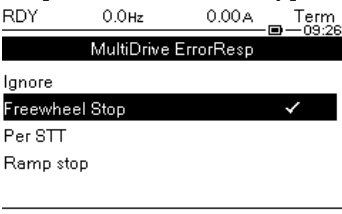
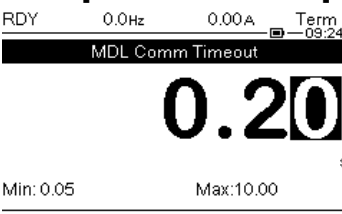
Configure the monitoring of the errors and warnings on master as below:

Step	Action
1	<p>Go to <b>[Complete settings] <math>C S E</math></b> → <b>[Pump functions] <math>P F E</math></b> → <b>[Level control] <math>L V L</math></b> → <b>[System architecture] <math>\Pi P q</math></b> → <b>[Multidrive Config] <math>\Pi P V C</math></b> menu</p>   
2	<p>Set <b>[MultiDrive ErrorResp] <math>\Pi d L b</math></b> to <b>[Freewheel Stop] <math>n 5 E</math></b></p> 

Step	Action
3	Set the [MDL Comm Timeout] <i>MDL Co</i> to 0.20s 

### Slaves Configuration

Configure the monitoring of the errors and warnings on slaves as below:

Step	Action
1	Go to [Complete settings] <i>C S E</i> → [Pump functions] <i>P F E</i> → [Level control] <i>L V L</i> → [System architecture] <i>PPQ</i> → [Multidrive Config] <i>PPV C</i> menu 
2	Set [MultiDrive ErrorResp] <i>MDL b</i> to [Freewheel Stop] <i>n S E</i> 
3	Set the [MDL Comm Timeout] <i>MDL Co</i> to 0.20s 

Step	Action
4	<p data-bbox="507 235 1204 264">Set [M/P Device ErrorResp] <i>11 P d b</i> to [Freewheel Stop] <i>n 5 t</i></p> <p data-bbox="507 268 853 297">RDY 0.0Hz 0.00A Term 09/26</p> <p data-bbox="507 302 853 331">M/P Device ErrorResp</p> <p data-bbox="507 336 853 365">Ignore</p> <p data-bbox="507 369 853 398">Freewheel Stop ✓</p> <p data-bbox="507 403 853 432">Per STT</p> <p data-bbox="507 436 853 465">Ramp stop</p> <hr data-bbox="507 470 853 481"/>

## System Architecture – Pumps Configuration

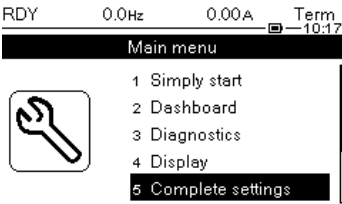
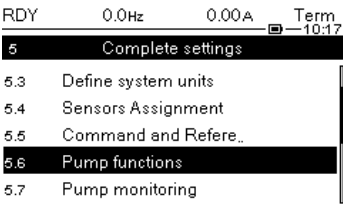
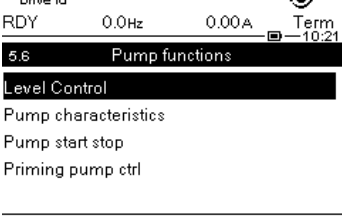
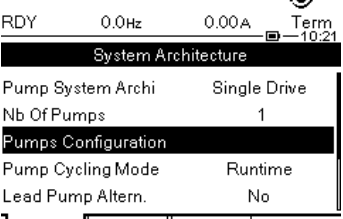
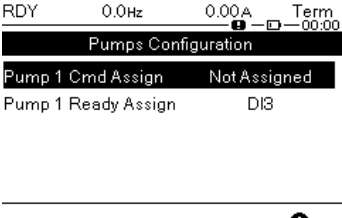
### Overview

For maintenance purpose, you can interlock a pump locally by activating a digital input.

In this configuration example, a drive will be not available when the digital input DI3 will be inactive.

### Steps by Step Configuration

The following table gives the steps by step configuration for the Pumps on each drive:

Step	Action
1	<p>Go to <b>[Complete settings]</b> <i>C S E</i> → <b>[Pump functions]</b> <i>P F E</i> → <b>[Level control]</b> <i>L V L</i> → <b>[System architecture]</b> <i>Π P 9</i> → <b>[Pump Configuration]</b> <i>P Π Π</i> menu</p>    
2	<p>Set <b>[Pump 1 Ready Assign]</b> <i>Π P , I</i> to <b>[DI3]</b> <i>L , 3</i>.</p> 

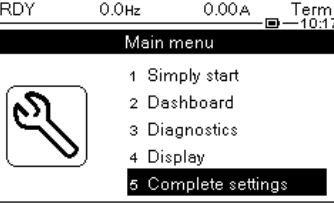
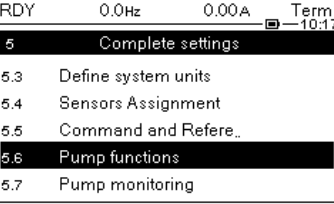
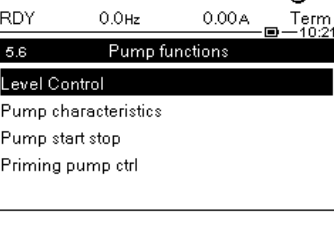
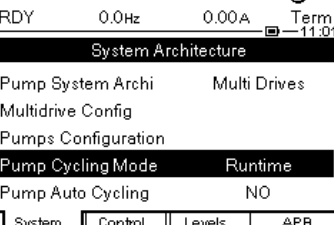
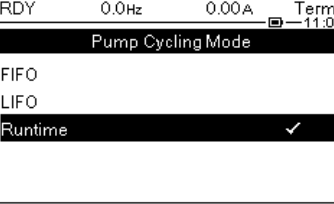
## System Architecture – Pump Cycling Parameters

### Overview

This functionality allows changing the start order of all available pumps in order to manage their wear.

In this configuration example, the cycling mode is based on running time. The available pump with the lowest running time is started first and the running pump with the highest running time is stopped first.

### Step by Step Configuration

Step	Action
1	<p>Go to <b>[Complete settings]</b> <i>C 5 E</i> → <b>[Pump functions]</b> <i>P F E</i> → <b>[Level control]</b> <i>L V L</i> → <b>[System architecture]</b> <i>Π P 9</i> → <b>[Pump Configuration]</b> <i>P Π P P</i> menu</p>    
2	<p>Set <b>[Pump Cycling Mode]</b> <i>Π P P C</i> to <b>[Runtime]</b> <i>r E Π E</i></p> 

# Level Control – Number of Pumps

## Overview

It is possible to have more pumps available than needed in a MultiPump architecture.

This configuration is needed, for example, if you have X pumps declared on the MultiDrive Link architecture but less than X pumps can cover the needs of the Level Control application.

If the number of pumps declared on the MultiDrive Link is the same as the number of pumps used in the Level Control application, this parameter can be set to 0.

In this configuration example, the maximum number of pumps used for the Level Control function is set to 3.

## Number of Pumps Configuration

Configure the number of pump as below:

Step	Action
1	<p>On master go to <b>[Complete settings] C S E</b> → <b>[Pump functions] P F E</b> → <b>[Level control] L V L</b> menu → <b>[Level Control] L C C</b> tab</p>
2	<p>Set <b>[LevelCtrl Nb Of Pumps] L C P n</b> to 3</p>

## Level Control – Random Factor

### Overview

The Level Control random factor allows adding a random start and stopping level to avoid sedimentation accumulation in the tank.

This parameter is a percentage of [Level 1st Pump Start] *L r L l* and [Level 1st Pump Stop] *L P L l* parameters.

In this configuration example, we set a random factor of 5%. At each start and stop, the drive will select a random value within this range.

### Steps by Step Configuration

The following table shows the step by step configuration of Level Control Random Factor:

Step	Action
1	<p>On master, go to [Complete settings] <i>L 5 E</i> → [Pump functions] <i>P F E</i> → [Level control] <i>L V L</i> menu → [Level Control] <i>L C C</i> tab</p>
2	<p>Set [LvlCtrl Random Factor] <i>L C r X</i> to 5.0%</p>

# Level Control – Error & Warning Handling

## Overview

Altivar Process ATV600 Drives manages several warnings and errors depending of the Level Control mode selection.

In this Application Note, the possible warning is:

- **[High Level Warning] L C H H**: this warning is active if the maximum level switch defined by **[Max Level Switch Assign] L C W L** is active.

The possible error is:

- **[Low Level Error] L C L F**: this error is activated if the minimum level switch defined by **[Min Level Switch Assign] L C W H** is active.

In factory setting configuration, the Level Control error response is set to ramp stop and can be adjusted depending of the application needs.

In this configuration example, the minimum level switch is wired to digital input DI5 and maximum level switch is wired to digital input DI6. The error response is changed to a freewheel stop.

## Step by Step Configuration

The following table gives the step by step configuration for the Level Control error:

Step	Action
1	<p>On master go to <b>[Complete settings] C 5 E</b> → <b>[Pump functions] P F E</b> → <b>[Level control] L V L</b> menu → <b>[Level Control] L C C</b> tab</p>
2	<p>Set <b>[LevelCtrl Error Resp] L C F B</b> to <b>[Ramp stop] r P P</b></p>



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# Part VIII

## Parameters Table

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### Introduction

The part shows all the parameters modified to allow configuration of the Level Control application.

### What is in This Section?

This section contains the following topics:

Parameters Table .....	50
------------------------	----

## Parameters Table

### Parameters List Used in this Note

The following table shows all the parameters modified to allow configuration of the Level Control application.

You can write the value for your application on the **Customer value** column.

You can use the SoMove *Altivar Process ATV600 : DTM* to store the configuration

Menu	Parameter	Application Note Setting	Customer value
[Simply start]	[Motor Standard] <i>b F r</i>	[50 Hz IEC] <i>5 D</i>	
	[Nominal Motor Power] <i>n P r</i>	5.50 kW	
	[Nom Motor Voltage] <i>u n 5</i>	400 Vac	
	[Nom Motor Current] <i>n C r</i>	11.20 A	
	[Nominal Motor Freq] <i>F r 5</i>	50.0 Hz	
	[Nominal Motor Speed] <i>n 5 P</i>	2,930 rpm	
	[Motor Th Current] <i>i t H</i>	11.20 A	
	[Acceleration] <i>A C C</i>	10.0 s	
	[Deceleration] <i>d E C</i>	10.0 s	
	[Low Speed] <i>L 5 P</i>	25.0 Hz	
	[High Speed] <i>H 5 P</i>	50.0 Hz	
[Macro Configuration]	[Application Selection] <i>A P P t</i>	[Pump Level Control] <i>L E V E L</i>	
[Define system units]	[P sensor unit] <i>S u P r</i>	[0.1 Bar] <i>D l b A r</i>	
	[Flow rate unit] <i>S u F r</i>	[0.1 m3/h] <i>D l n 3 H</i>	
[Eth Module Config]	[ETH Option IP Mode]	[Fixed] <i>n A n u</i>	
	[IP address]	_( <sup>1</sup> )	
	[Mask]	_( <sup>1</sup> )	
[Level Control]	[Pump System Archi] <i>n P 5 A</i>	[Multi Drives] <i>n V 5 d</i>	
	[M/P Device Role] <i>n P d t</i>	_( <sup>1</sup> )	
	[Nb of Devices] <i>n P G n</i>	3	
	[M/P Device ID] <i>n G i d</i>	_( <sup>1</sup> )	
	[MultiDrive ErrorResp] <i>n d L b</i>	[Freewheel Stop] <i>n 5 t</i>	
	[MDL Comm Timeout] <i>n L t o</i>	0.20s	
	[M/P Device ErrorResp] <i>n P d b</i>	[Freewheel Stop] <i>n 5 t</i>	
	[Pump Cycling Mode] <i>n P P C</i>	[Runtime] <i>r t i n E</i>	
	[LevelCtrl Mode] <i>L C n</i>	[Emptying] <i>E n P t Y</i>	
	[LevelCtrl Nb of Pumps] <i>L C P n</i>	3	
	[LevelCtrl Sensor Type] <i>L C n t</i>	[Level sensor] <i>L E V L</i>	
	[Level Sensor Assign] <i>L C 5 A</i>	[AI1] <i>A i 3</i>	
	[AI3 Type] <i>A i 3 t</i>	[Current] <i>D A</i>	
	[AI3 Min. Value] <i>C r L 3</i>	4.0 mA	
	[AI3 Max Value] <i>C r H 3</i>	20.0 mA	
	[AI3 Lowest Process] <i>A i 3 J</i>	0	
	[AI3 Highest Process] <i>A i 3 K</i>	1000	
[Empty Tank Level] <i>L C t J</i>	0.00m		

Menu	Parameter	Application Note Setting	Customer value
	[Full Tank Level] <i>L C t K</i>	5.00m	
	[LevelCtrl Strategy] <i>L C 5 t</i>	[Standard] <i>b A 5 i C</i>	
	[LevelCtrl Low Speed] <i>L C L 5</i>	35.0 Hz	
	[Level 1st Pump Start] <i>L r L 1</i>	30.0 Hz	
	[Level 1st Pump Stop] <i>L P L 1</i>	20.0 Hz	
	[Level 1st Pump HSP] <i>L H L 1</i>	45.0 Hz	
	[Level 2nd Pump Start] <i>L r L 2</i>	50.0 Hz	
	[Level 2nd Pump Stop] <i>L P L 2</i>	40.0 Hz	
	[Level 2nd Pump HSP] <i>L H L 2</i>	65.0 Hz	
	[Level 3rd Pump Start] <i>L r L 3</i>	70.0 Hz	
	[Level 3rd Pump Stop] <i>L P L 3</i>	60.0 Hz	
	[Level 3rd Pump HSP] <i>L H L 3</i>	85.0 Hz	
	[LvlCtrl Random Factor] <i>L C r X</i>	5.0%	
	[Min Lvl Switch Assign] <i>L C W L</i>	-	
	[Max Lvl Switch Assign] <i>L C W H</i>	-	
	[LevelCtrl Error Resp] <i>L C F b</i>	[Ramp stop] <i>r P P</i>	

**NOTE:** <sup>(1)</sup>: Depend on the drive : Master or Slaves.

