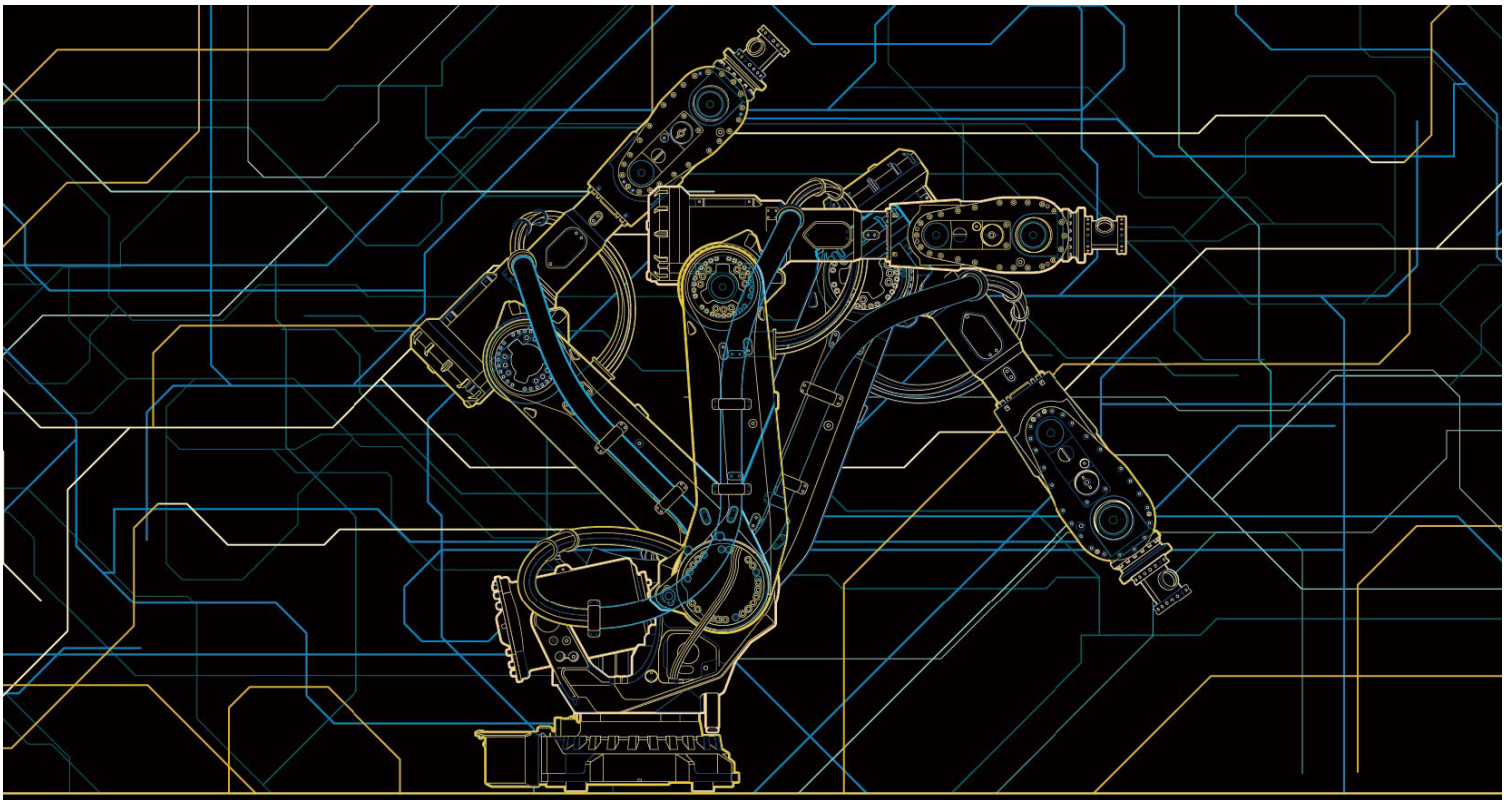

Product manual
FlexPLP IRPLP 050

Power and productivity
for a better world™

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Additional copies of this manual may be obtained from ABB.

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Product manual

FlexPLP IRPLP 050

3HAW050008850

Revison: J

0.0.1. Overview of this manual

About this manual

This manual contains instructions for:

- the characteristics of the FlexPLP IRPLP 050
- mechanical and electrical installation instructions for the FlexPLP IRPLP 050
- maintenance instructions for the FlexPLP IRPLP 050
- spare parts

Usage

This manual should be used when working during:

- installation, from lifting the FlexPLP IRPLP 050 to its work site and securing it to the foundation, to making it ready for operation
- maintenance work
- repair work.

Who should read this manual?

This manual is intended for:

- installation personnel
- maintenance personnel
- repair personnel.

Prerequisites

A maintenance /repair/ installation craftsman working with an ABB FlexPLP IRPLP 050 must:

- be trained by ABB and have the required knowledge of mechanical and electrical installation/repair/maintenance work.

Organization of chapters

The manual is organized in the following chapters:

Chapter	Content
Safety	Safety information that must be read through before performing any installation or service work on the FlexPLP IRPLP 050. Contains general safety aspects as well as more specific information about how to avoid personal injuries and damage to the product.
Description and technical details	Specifications and characteristics of the FlexPLP IRPLP 050.
Unpacking, acceptance and handling	Information relative to the steps following the reception of the FlexPLP IRPLP 050, until its installation.
Maintenance	Step-by-step procedures that describe how to perform maintenance of the FlexPLP. Based on a maintenance schedule that may be used in the work of planning periodical maintenance.
Spare parts	List of the spare parts available for the FlexPLP IRPLP 050.

References

Reference (ABB manuals)	Document ID
Product manual - IRC5 Robot Controller	3HAC021313-001
Product Manual - RC5 Compact	3HAC035738-001
Service Information System - IRC5	3HAC025709-001
Application manual - Additional axes and stand alone controller	3HAC021395-001
Operating manual - IRC5 with FlexPendant	3HAC16590
System Parameters	3HAC17076
Technical reference manual - RAPID Instructions, Functions, Data types	3HAC16581

Revisions

Revision	Description
F	First major revision
G	Internal wiring update: Spare parts added and drawing updated for PLP manufactured with internal cables Harting type version 2013.
H	Spare parts added motor used from 2013 on.
I	• Change FlexPLP to FlexPLP IRPLP050. • Update robot controller requirement. • Update SMB information • Add electrical wiring diagrams • Update the Z calibration pictures
J	• Update the maximum number of motion tasks from 6 to 7. • Add environment information symbol. • Add warning for the Klüber Microlube GB0 grease.

0.0.2. Product documentation, M2004

Categories for manipulator documentation

The manipulator documentation is divided into a number of categories. This listing is based on the type of information in the documents, regardless of whether the products are standard or optional.

All documents listed can be ordered from ABB on a DVD. The documents listed are valid for M2004 manipulator systems.

Product manuals

All hardware, manipulators and controllers will be delivered with a **Product manual** that contains:

- Safety information.
- Installation and commissioning (descriptions of mechanical installation, electrical connections).
- Maintenance (descriptions of all required preventive maintenance procedures including intervals).
- Repair (descriptions of all recommended repair procedures including spare parts).
- Additional procedures, if any (calibration, decommissioning).
- Reference information (article numbers for documentation referred to in Product manual, procedures, lists of tools, safety standards).
- Parts list.
- Foldouts or exploded views.
- Circuit diagrams (or references to circuit diagrams).

Technical reference manuals

The technical reference manuals describe the manipulator software in general and contain relevant reference information.

- **RAPID Overview**: An overview of the RAPID programming language.
- **RAPID Instructions, Functions and Data types**: Description and syntax for all RAPID instructions, functions, and data types.
- **RAPID Kernel**: A formal description of the RAPID programming language.
- **System parameters**: Description of system parameters and configuration workflows.

Application manuals

Specific applications (for example software or hardware options) are described in **Application manuals**. An application manual can describe one or several applications.

An application manual generally contains information about:

- The purpose of the application (what it does and when it is useful).
- What is included (for example cables, I/O boards, RAPID instructions, system parameters, CD with PC software).
- How to use the application.
- Examples of how to use the application.

Operating manuals

The operating manuals describe hands-on handling of the products. The manuals are aimed at those having first-hand operational contact with the product, that is production cell operators, programmers, and trouble shooters.

The group of manuals includes:

- **Emergency safety information**
- **General safety information**
- **Getting started, IRC5 and RobotStudio**
- **IRC5 with FlexPendant**
- **RobotStudio**
- **Introduction to RAPID**
- **Trouble shooting**, for the controller and manipulator.

0.0.3. How to read the product manual

Reading the procedures

The procedures contain references to figures, tools, material etc. The references are read as described below.

References to figures

The procedures often include references to components or attachment points located on the robot/controller. The components or attachment points are marked with *italic text* in the procedures and completed with a reference to the figure where the current component or attachment point is shown.

The denomination in the procedure for the component or attachment point corresponds to the denomination in the referenced figure.

The table below shows an example of a reference to a figure from a step in a procedure.

	Action	Note/Illustration
8.	Remove the rear attachment screws, gearbox.	Shown in the figure *Location of gearbox on page xx*.

Reference to required equipment

The procedures often include references to equipment (spare parts, tools etc.) required for the different actions in the procedure. The equipment is marked with italic text in the procedures and completed with a reference to the section where the equipment is listed with further information, i.e. article number, dimension.

The denomination in the procedure for the component or attachment point corresponds to the denomination in the referenced list.

The table below shows an example of a reference to a list of required equipment, from a step in a procedure.

	Action	Note/Illustration
3.	Fit a new sealing, 2 to the gearbox.	Art. no. is specified in *Required equipment on page xx*.

Safety information

The manual includes a separate safety chapter that must be read through before proceeding with any service or installation procedures. All procedures also include specific safety information when dangerous steps are to be performed.

Read more in *Safety on page 11*.

1 Safety

1.1. Introduction

Overview

The safety information in this manual is divided in two categories:

- general safety aspects, important to attend to before performing any service work on the robot. These are applicable for all service work and are found in *General safety information on page 12*.
- specific safety information, pointed out in the procedure at the moment of the danger. How to avoid and eliminate the danger is either detailed directly in the procedure, or further detailed in separate instructions, found in *Safety related instructions on page 29*.

1.2 General safety information

1.2.1. Safety in the robot system

Validity and responsibility

The information does not cover how to design, install and operate a complete system, nor does it cover all peripheral equipment, which can influence the safety of the total system. To protect personnel, the complete system must be designed and installed in accordance with the safety requirements set forth in the standards and regulations of the country where the robot is installed.

The users of ABB industrial robots are responsible for ensuring that the applicable safety laws and regulations in the country concerned are observed and that the safety devices necessary to protect people working with the robot system are designed and installed correctly. Personnel working with robots must be familiar with the operation and handling of the industrial robot, described in the applicable documents, e.g. User's Guide and Product Manual.

Connection of external safety devices

Apart from the built-in safety functions, the robot is also supplied with an interface for the connection of external safety devices. Via this interface, an external safety function can interact with other machines and peripheral equipment. This means that control signals can act on safety signals received from the peripheral equipment as well as from the robot.

Limitation of liability

Any information given in this manual regarding safety, must not be construed as a warranty by ABB that the industrial robot will not cause injury or damage even if all safety instructions are complied with.

Related information

Type of information	Detailed in document	Section
Installation of safety devices	Product manual for the robot	Installation and commissioning
Changing robot modes	Operators manual (RobotWare 5.0)	Operating modes
Restricting the working space	Product manual for the robot	Installation and commissioning

1.3 Safety risks related to the robot

1.3.1. Safety risks during installation and service work on robot

Overview

This section includes information of general safety risks to be considered when performing installation and service work on the robot.

General risks during installation and service

- The instructions in the Product Manual - Installation and Commissioning must always be followed.
- Emergency stop buttons must be positioned in easily accessible places so that the robot can be stopped quickly.
- Those in charge of operations must make sure that safety instructions are available for the installation in question.
- Those who install the robot must have the appropriate training for the robot system in question and in any safety matters associated with it.

Nation/region specific regulations

To prevent injuries and damage during the installation of the robot system, the regulations applicable in the country concerned and the instructions of ABB Robotics must be complied with.

Non-voltage related risks

- Safety zones, which have to be crossed before admittance, must be set up in front of the robot's working space. Light beams or sensitive mats are suitable devices.
- Turntables or the like should be used to keep the operator out of the robot's working space.
- The axes are affected by the force of gravity when the brakes are released. In addition to the risk of being hit by moving robot parts, you run the risk of being crushed by the parallel arm.
- Energy, stored in the robot for the purpose of counterbalancing certain axes, may be released if the robot, or parts thereof, are dismantled.
- When dismantling/assembling mechanical units, watch out for falling objects.
- Be aware of stored heat energy in the controller.
- Never use the robot as a ladder, i.e. do not climb on the robot motors or other part during service work. There is a serious risk of slipping because of the high temperature of the motors or oil spills that can occur on the robot.

To be observed by the supplier of the complete system

- The supplier of the complete system must ensure that all circuits used in the safety function are interlocked in accordance with the applicable standards for that function.
- The supplier of the complete system must ensure that all circuits used in the emergency stop function are interlocked in a safe manner, in accordance with the applicable standards for the emergency stop function.

1.3.1. Safety risks during installation and service work on robot

Complete robot

Safety risk	Description
Hot components! Removed parts may result in collapse of robot!	 Caution signal **Caution!** Motors and gears are HOT after running the robot! Touching the motors and gears may result in burns!  Warning signal **Warning!** Take any necessary measures to ensure that the robot does not collapse as parts are removed, e.g. secure the lower arm with fixtures if removing motor, axis 2.

Cabling

Safety risk	Description
Cable packs are sensitive to mechanical damage!	 Caution signal **Caution!** The cable packs are sensitive to mechanical damage! They must be handled with care, especially the connectors, in order to avoid damaging them!

Gearboxes and motors

Safety risk	Description
Gears may be damaged if excessive force is used!	 Caution signal **Caution!** Whenever parting/mating motor and gearbox, the gears may be damaged if excessive force is used!

1.3.2. Safety risks related to tools/workpieces

Safe handling

It must be possible to safely turn off tools, such as milling cutters, etc. Make sure that guards remain closed until the cutters stop rotating.

It should be possible to release parts by manual operation (valves).

Safe design

Grippers/end effectors must be designed so that they retain workpieces in the event of a power failure or a disturbance of the controller.

Ensure that a gripper is prevented from dropping a workpiece, if such is used.

1.3.3. Safety risks related to pneumatic/hydraulic systems

General

Special safety regulations apply to pneumatic and hydraulic systems.

Residual energy

- Residual energy may be present in these systems. After shutdown, particular care must be taken.
- The pressure in pneumatic and hydraulic systems must be released before starting to repair them.

Safe design

- Gravity may cause any parts or objects held by these systems to drop.
- Dump valves should be used in case of emergency.
- Shot bolts should be used to prevent tools, etc., from falling due to gravity.

1.3.4. Safety risks during operational disturbances

General

- The industrial robot is a flexible tool which can be used in many different industrial applications.
- All work must be carried out professionally and in accordance with the applicable safety regulations.
- Care must be taken at all times.

Qualified personnel

- Corrective maintenance must only be carried out by qualified personnel who are familiar with the entire installation as well as the special risks associated with its different parts.

Extraordinary risks

If the working process is interrupted, extra care must be taken due to risks other than those associated with regular operation. Such an interruption may have to be rectified manually.

1.3.5. Risks associated with live electric parts

Voltage related risks, general

- Although troubleshooting may, on occasion, have to be carried out while the power supply is turned on, the robot must be turned off (by setting the mains switch to OFF) when repairing faults, disconnecting electric leads and disconnecting or connecting units.
- The mains supply to the robot must be connected in such a way that it can be turned off outside the robot's working space.

Voltage related risks, controller IRC5

A danger of high voltage is associated with the following parts:

- Be aware of stored electrical energy (DC link, Ultra Cap unit) in the controller.
- Units inside the controller, e.g. I/O modules, can be supplied with power from an external source.
- The mains supply/mains switch
- The transformers
- The power unit
- The control power supply (230 VAC)
- The rectifier unit (400-480 VAC and 700 VDC. Note: Capacitors!)
- The drive unit (700 VDC)
- The drive system power supply (230 VAC)
- The service outlets (115/230 VAC)
- The customer power supply (230 VAC)
- The power supply unit for tools, or special power supply units for the machining process.
- The external voltage connected to the control cabinet remains live even when the robot is disconnected from the mains.
- Additional connections.

Voltage related risks, robot

A danger of high voltage is associated with the robot in:

- The power supply for the motors (up to 800 VDC).
- The user connections for tools or other parts of the installation (max. 230 VAC, see chapter Installation and commissioning in the Product manual).

Voltage related risks, tools, material handling devices, etc.

Tools, material handling devices, etc., may be live even if the robot system is in the OFF position. Power supply cables which are in motion during the working process may be damaged.

1.4 Safety actions related to the robot

1.4.1. Safety fence dimensions

General

Install a safety cell around the robot to ensure safe robot installation and operation.

Dimensioning

Dimension the fence or enclosure to enable it to withstand the force created if the load being handled by the robot is dropped or released at maximum speed. Determine the maximum speed from the maximum velocities of the robot axes and from the position at which the robot is working in the work cell (see *Product Specification - Description, Robot Motion*).

Also consider the maximum possible impact caused by a breaking or malfunctioning rotating tool or other device fitted to the manipulator.

1.4.2. Fire extinguishing

Use a CARBON DIOXIDE (CO2) extinguisher in the event of a fire in the robot (manipulator or controller)!

1.4.3. Emergency release of the robots/manipulators axes

Description

In an emergency situation, any of the robot's/manipulators axes may be released manually by pushing the brake release buttons on the robot.

How to release the brakes is detailed in the robot product manual.

- The robot arm may be moved manually on smaller robot models, but larger models may require using an overhead crane or similar.

Increased injury

Before releasing the brakes, make sure that the weight of the arms does not increase the pressure on the trapped person, further increasing any injury!

1.4.4. Brake testing

When to test

During operation the holding brakes of each axis motor wear normally. A test may be performed to determine whether the brake can still perform its function.

How to test

The function of each axis' motor holding brakes may be checked as detailed below:

1. Run each manipulator axis to a position where the combined weight of the manipulator arm and any load is maximized (max. static load).
2. Switch the motor to the MOTORS OFF position with the Operating mode selector on the controller.
3. Check that the axis maintains its position.

If the manipulator does not change position as the motors are switched off, then the brake function is adequate.

1.4.5. Risk of disabling function "Reduced speed 250 mm/s"

Do not change *Transm. gear ratio* or other kinematic parameters from the Teach Pendant Unit or a PC. This will affect the safety function Reduced speed 250 mm/s.

1.4.6. Safe use of the Teach Pendant Unit

The enabling device is a push button located on the side of the Teach Pendant Unit (TPU) which, when pressed halfway in, takes the system to MOTORS ON. When the enabling device is released or pushed all the way in, the robot is taken to the MOTORS OFF state. To ensure safe use of the Teach Pendant Unit, the following must be implemented:

- The enabling device must never be rendered inoperative in any way.
- During programming and testing, the enabling device must be released as soon as there is no need for the robot to move.
- The programmer must always bring the Teach Pendant Unit with him/her, when entering the robot's working space. This is to prevent anyone else taking control of the robot without the programmer knowing.

1.4.7. Work inside the manipulator's working range

If work must be carried out within the robot's work envelope, the following points must be observed:

- The operating mode selector on the controller must be in the manual mode position to render the enabling device operative and to block operation from a computer link or remote control panel.
- The robot's speed is limited to max. 250 mm/s when the operating mode selector is in position < 250 mm/s. This should be the normal position when entering the working space. The position 100% "full speed" may only be used by trained personnel who are aware of the risks that this entails.
- Pay attention to the rotating axes of the manipulator! Keep a distance to the axes in order not to get entangled with hair or clothing. Also be aware of any danger that may be caused by rotating tools or other devices mounted on the manipulator or inside the cell.

1.4.8. Translate the information on safety and information labels

Labels on the product

Both the manipulator and the controller are marked with several safety and information labels, containing important information about the product. The information is useful for all personnel handling the robot system, e.g. during installation, service or operation.

Translation possibilities

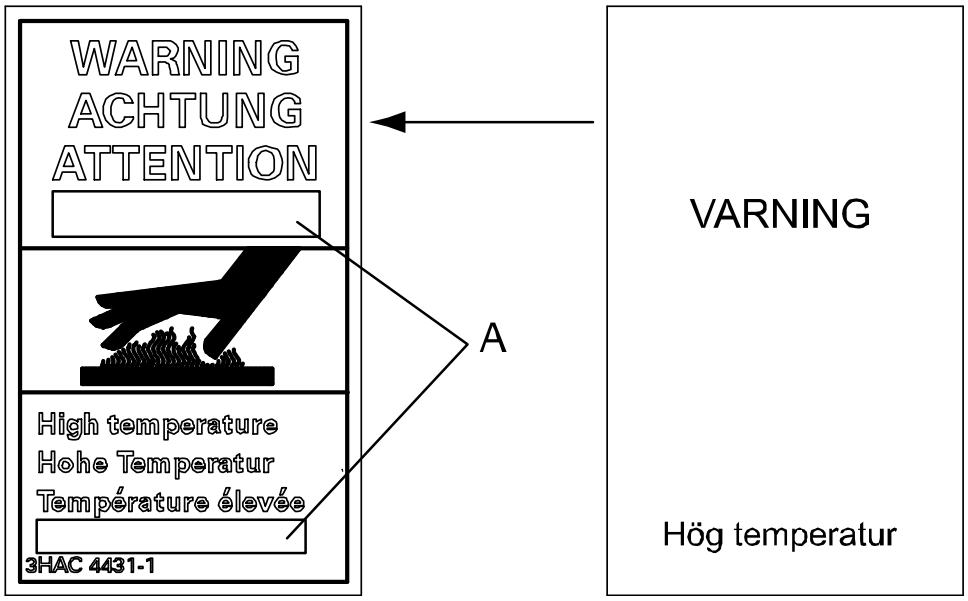
The labels fitted to the product contain space for adding a fourth language underneath the three standard languages (English, German and French).

Add a local language to the label by:

- using a transparent sticker over the standard label with text added in a fourth language. Drawings detailing the design (text, figure, dimensions) of the standard labels can be ordered from ABB. Notice that each label is identified according to the article number located in the lower corner of the label.

Example of transparent sticker

The figure below shows the location of the free space on one of the labels on the robot, where the fourth language can be added. The figure also shows a transparent sticker, containing the text in Swedish.



xx0500002517

A	Free space for adding a fourth language

1.5 Safety stops

1.5.1. What is an emergency stop?

Definition of emergency stop

An emergency stop is a state that overrides any other manipulator control, disconnects drive power from the manipulator motors, stops all moving parts, and disconnects power from any potentially dangerous functions controlled by the manipulator system.

An emergency stop state means that all power is disconnected from the manipulator except for the manual brake release circuits. You must perform a recovery procedure, i.e, resetting the emergency stop button and pressing the Motors On button, in order to return to normal operation.

The manipulator system can be configured so that the emergency stop results in either:

- An uncontrolled stop, immediately stopping the manipulator actions by disconnecting power from the motors.
- A controlled stop, stopping the manipulator actions with power available to the motors so that the manipulator path can be maintained. When completed, power is disconnected.

The default setting is uncontrolled stop. However, controlled stops are preferred since they minimize extra, unnecessary wear on the manipulator and the actions needed to return the manipulator system back to production. Please consult your plant or cell documentation to see how your manipulator system is configured.

The emergency stop function may only be used for the purpose and under the conditions for which it is intended.

The emergency stop function is intended for immediately stopping equipment in the event of an emergency.

Emergency stop should not be used for normal program stops as this causes extra, unnecessary wear on the manipulator.

Classification of stops

The safety standards that regulates automation and manipulator equipment defines categories in which each type of stop applies:

If the stop is... ...	then it is classified as...
uncontrolled	category 0 (zero)
controlled	category 1

Emergency stop devices

In a manipulator system there are several emergency stop devices that can be operated in order to achieve an emergency stop. There are emergency stop buttons available on the Flex-

1.5.1. What is an emergency stop?

Pendant and on the controller cabinet (on the Control Module on a Dual Cabinet Controller).There can also be other types of emergency stops on your manipulator, consult your plant or cell documentation to see how your manipulator system is configured.

1.6 Safety related instructions

1.6.1. Safety signals in the manual

Introduction to safety signals

This section specifies all dangers that may arise from performing the work detailed in the manual. Each danger is detailed in its own section consisting of:

- A caption specifying the danger level (DANGER, WARNING or CAUTION) and the type of danger.
- A brief description of what will happen if the operator/service personnel do not eliminate the danger.
- An instruction of how to eliminate the danger to facilitate performing the activity at hand.

Danger levels

The table below defines the captions specifying the danger levels used throughout this manual.

Symbol	Designation	Signification
 danger	DANGER	Warns that an accident will occur if the instructions are not followed, resulting in a serious or fatal injury and/or severe damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height etc.
 warning	WARNING	Warns that an accident may occur if the instructions are not followed, that can lead to serious injury, possibly fatal, and/or great damage to the product. It applies to warnings that apply to danger with, for example, contact with high voltage electrical units, explosion or fire risk, risk of poisonous gases, risk of crushing, impact, fall from height etc.
 Electrical shock	ELECTRICAL SHOCK	The electrocution or electrical shock symbol indicates electrical hazards which could result in severe personal injury or death.
 caution	CAUTION	Warns that an accident may occur if the instructions are not followed, that can result in injury and/or damage to the product. It also applies to warnings of risks that include burns, eye injury, skin injury, hearing damage, crushing or slipping, tripping, impact, fall from height etc. Furthermore, it applies to warnings that include function requirements when fitting and removing equipment, where there is a risk of damaging the product or causing a breakdown.

1.6.1. Safety signals in the manual

Symbol	Designation	Signification
 Electrostatic discharge (ESD)	ELECTROSTATIC DISCHARGE (ESD)	The electrostatic discharge (ESD) symbol indicates electrostatic hazards which could result in severe damage to the product.
 Magnetic fields	MAGNETIC FIELDS	An intense and/or variable magnetic field can affect or damage certain electrical devices like cardiac pacemakers.
 Note	NOTE	Note symbols alert you to important facts and conditions.
 Tip	TIP	Tip symbols direct you to specific instructions, where to find additional information or how to perform a certain operation in an easier way.

2 Product description

2.1. Product overview

General

The FlexPLP IRPLP 050 is a Programmable Linear Positioner. It is a versatile tool designed for a wide range of industrial applications. In particular, it can be used as a programmable locator for a vehicle reference, positioning a locating pin or a clamping unit.

Modularity

The IRPLP 050 is based on a modular concept and can be constituted of one to three linear axes: one or two horizontal axes, with or without a vertical axis; or the vertical axis alone. The horizontal axes offer up to 400 mm of stroke and the stroke of the vertical axis is 200 mm.

The IRPLP 050 must be installed on a surface plate. It can be mounted upside down (“ceiling mount”).

Operating system

The IRPLP 050 functions with the IRC5 controller and robot control software RobotWare, which supports every aspect of the robot system, such as motion control, development and execution of application programs, communication, etc.

See *Product specification - Controller IRC5 with FlexPendant*.

The IRPLP 050 can be controlled by an IRC5 or an IRC5 Compact.

Internal piping and wiring

The IRPLP 050 integrates an internal electro-pneumatic wiring in order to control an actuator mounted on the upper plate, such as a clamping device, a mobile controller or a multi-function controller.

Complete protection

Steel covers on the IRPLP 050 fully protect the internal mechanics and the internal wiring from environment pollution such as weld splatter. The IRPLP 050 is rated International Protection IP54.

2.2. Terminology

You'll find in the table hereunder some explanations regarding the terms used in this manual:

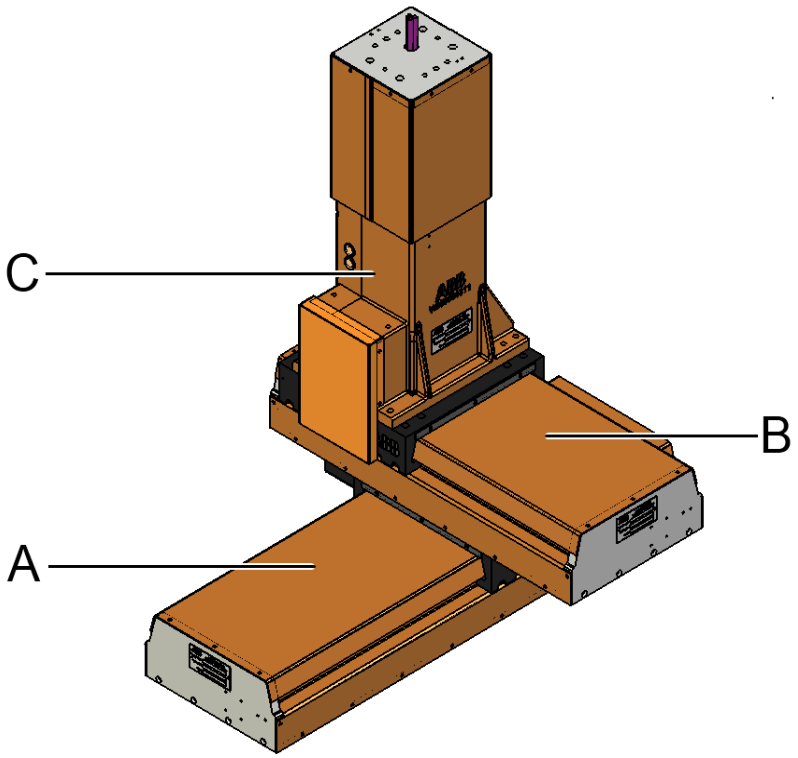
Designation	Definition
Axis (or linear axis)	In this document, the term axis is often used to designate a linear axis, i.e., a mechanical unit that possesses a carriage describing movement along a straight line.
Ballscrew	The ballscrew is the mechanical component that transforms rotational movement from the motor into linear movement with little friction. The ballscrews mounted on the IRPLP 050 are characterized by their stroke and their dimension D_0x p: nominal diameter x pitch.
Carriage	The carriage is the mechanical component that travels along the axis. The carriage table can be used to support a linear axis or the customer equipment.
Control system	Controller such as IRC5 or IRC5 Compact.
Horizontal	Parallel to the horizon plane.
Mounting surface	Upper surface of one axis carriage, onto which another axis or a tooling can be mounted.
SMB	The serial measurement board (SMB) primarily gathers resolver data from the motors. This data is used to measure the speed and position of each axis. It also stores a number of data pertaining to each unit. This data is used by the controller and can be transferred between the SMB and the controller. The serial measurement board is a necessary link between the controller and the PLP motors.
Travel length or Stroke	Maximum displacement of one carriage.
Servo Motor	A motor used for motion control in robots. A servomotor is paired with an encoder to provide position/speed feedback.
Surface plate	A solid, flat plate used as the main horizontal reference plane and to which the unit must be fastened.
Vertical	Positioned at a right angle to the horizon.
Workpiece	A part that is being worked on. It may be subject to handling, welding, or other operations.

2.3. Axes combinations

Modularity

The IRPLP 050 can be constituted of one to three axes: one or two horizontal axes, with or without a vertical axis, or the vertical axis alone.
The horizontal axes are available with a stroke of 300 or 400 mm, and the stroke of vertical axis is 200 mm.

	Horizontal axis one (A)	Horizontal axis two (B)	Vertical axis (C)
3 axes	Stroke 400 mm	Stroke 400 mm	Stroke 200 mm
	Stroke 400 mm	Stroke 300 mm	Stroke 200 mm
	Stroke 300 mm	Stroke 400 mm	Stroke 200 mm
	Stroke 300 mm	Stroke 300 mm	Stroke 200 mm
2 axes	Stroke 400 mm	-	Stroke 200 mm
	Stroke 400 mm	Stroke 400 mm	-
	Stroke 400 mm	Stroke 300 mm	-
	Stroke 300 mm	-	Stroke 200 mm
	Stroke 300 mm	Stroke 400 mm	-
	Stroke 300 mm	Stroke 300 mm	-
1 axis	Stroke 400 mm	-	-
	Stroke 300 mm	-	-
	-	-	Stroke 200 mm



IRPLP 050 Overview

2.4. Performances

IRPLP 050 overall specifications

Below are the overall specification of the IRPLP 050.

Specification	Horizontal axis	Vertical axis	3 axis IRPLP 050
Stroke	300 mm or 400 mm	200 mm	See per axis
Repeatability[1)]	±0.05 mm/s[1)]	±0.05 mm/s[1)]	±0.05 mm/s[1)]
Maximum speed	200 mm/s[2)]	100 mm/s	See per axis
Acceleration time	< 0.2s	< 0.2s	< 0.2s
Static load	150 kg	150 kg	150 kg
Dynamic load	50 kg	50 kg	50 kg
Mass	44 kg / 46 kg	40 kg	128 to 132 kg
Protection index	IP 54	IP 54	IP 54

[1)] Per ISO9283

[2)] Speed for an axis equipped with a ballscrew type 16x5.
If the axis is equipped with a ballscrew type 16x2 (in option for special applications), the maximum speed is 100mm/s.

IRPLP 050 motor specifications

Below are the specifications of the motor used on the PLP:

Specification	Performance
Power	400 W
Nominal speed	3000 rpm
Voltage	400 V AC
Torque	1.27 N/m
Brake voltage	24 V
Brake torque	1.27 N/m

Ambient temperature

Description	Standard/ Option	Temperature
IRPLP050 during operation	Standard	+5°C (41°F) to +40°C (104°F)
IRPLP050 during transportation and storage	Standard	-25°C (-13°F) to +55°C (131°F)
For short periods (not exceeding 24 hours)	Standard	Up to +70°C (158°F)

2.5 Dimensions

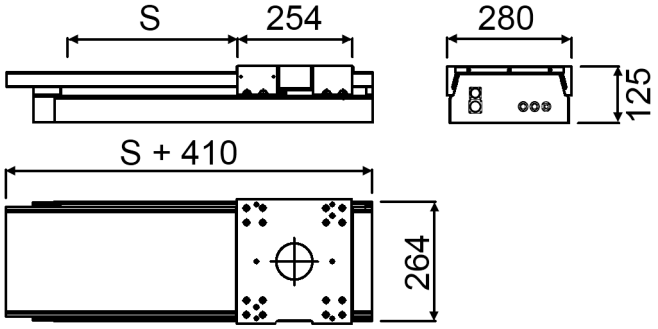
2.5.1. Dimensions 1 axis IRPLP 050

IRPLP 050 1 horizontal axis

The dimensions of a IRPLP 050 horizontal axis depend on its stroke.

The figure below shows the dimensions with:

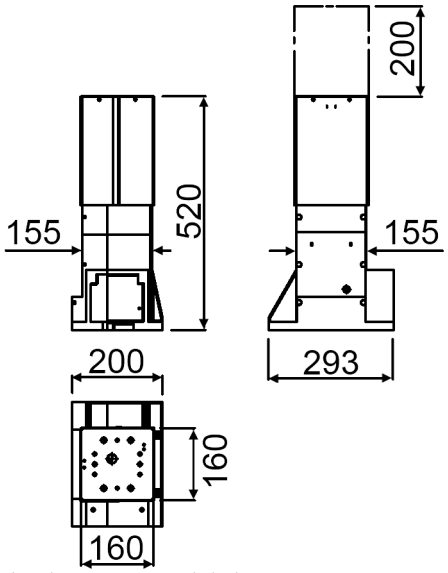
S = Stroke. S = 300 mm or 400 mm.



Dimensions IRPLP 050 1 horizontal axis

IRPLP 050 1 vertical axis

The figure below shows the dimensions of the vertical axis in low position. The stroke of the vertical axis is 200mm.



Dimensions IRPLP 050 1 vertical axis

2.5.2. Dimensions 2 axis IRPLP 050

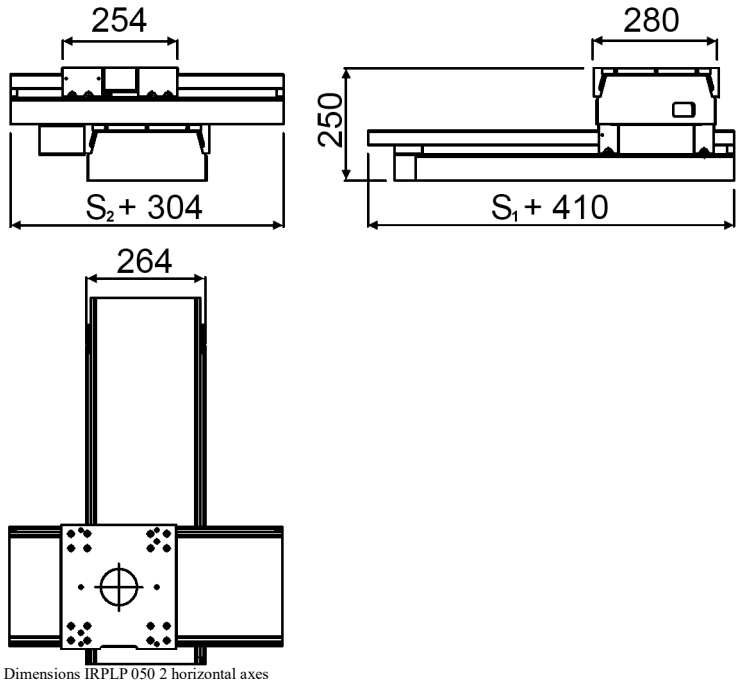
IRPLP 050 2 horizontal axes

The dimensions of the IRPLP 050 unit depend on the stroke of the horizontal axes.

The figure below shows the unit dimensions with:

S_1 = Stroke of the first axis. S_1 = 300 mm or 400 mm.

S_2 = Stroke of the second axis. S_2 = 300 mm or 400 mm.



Dimensions IRPLP 050 2 horizontal axes

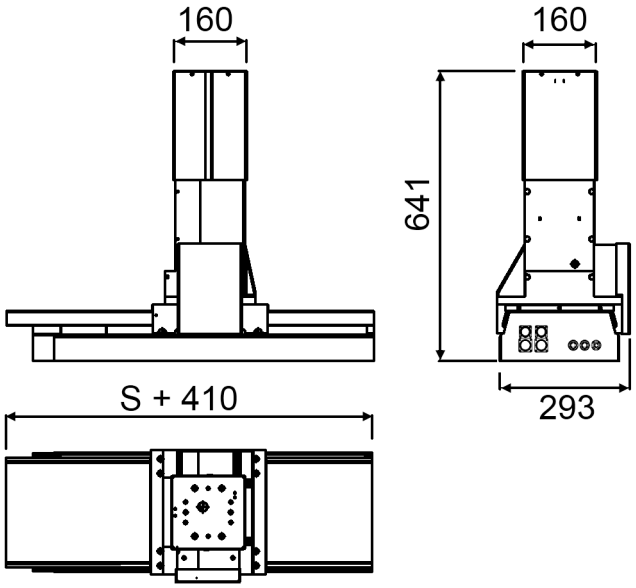
IRPLP 050 1 horizontal and 1 vertical axis

The dimensions of a IRPLP 050 horizontal axis depend on its stroke.

The figure below shows the dimensions with:

S = Stroke. S = 300 mm or 400 mm.

The dimensions are given with the vertical axis in low position. The stroke of the vertical axis is 200mm.



IRPLP 050 1 horizontal and 1 vertical axis

2.5.3. Dimensions 3 axis IRPLP 050

IRPLP 050 3 axis

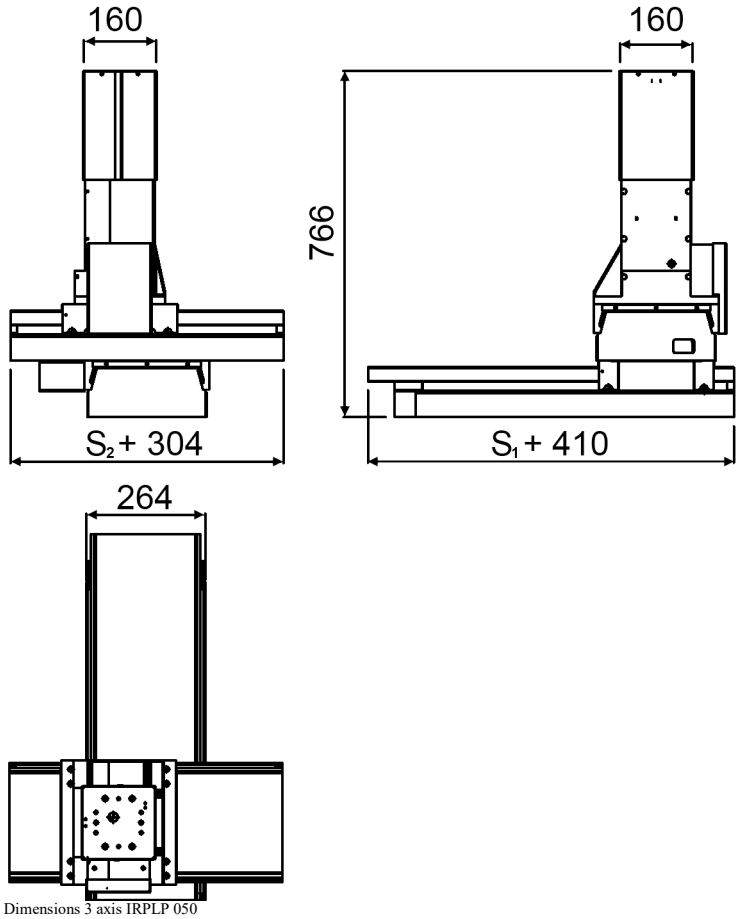
The dimensions of the IRPLP 050 unit depend on the strokes of the horizontal axes.

The figure below shows the unit dimensions with:

S_1 = Stroke of the first axis. S_1 = 300 mm or 400 mm.

S_2 = Stroke of the second axis. S_2 = 300 mm or 400 mm.

The dimensions are given with the vertical axis in low position. The stroke of the vertical axis is 200mm.



Dimensions 3 axis IRPLP 050

2.6. Weight

Weight

The weight of the complete mechanical unit depends on the configuration. Hereunder are the weight of each axis type and the total weight of each available combination of axis:

Axis type	Weight
Horizontal axis stroke 400 mm	46 kg
Horizontal axis stroke 300 mm	44 kg
Vertical axis	40 kg

	Horizontal axis one	Horizontal axis two	Vertical axis	Weight
3 axes	Stroke 400 mm	Stroke 400 mm	Stroke 200 mm	132 kg
	Stroke 400 mm	Stroke 300 mm	Stroke 200 mm	130 kg
	Stroke 300 mm	Stroke 400 mm	Stroke 200 mm	130 kg
	Stroke 300 mm	Stroke 300 mm	Stroke 200 mm	128 kg
2 axes	Stroke 400 mm	-	Stroke 200 mm	86 kg
	Stroke 400 mm	Stroke 400 mm	-	92 kg
	Stroke 400 mm	Stroke 300 mm	-	90 kg
	Stroke 300 mm	-	Stroke 200 mm	84 kg
	Stroke 300 mm	Stroke 400 mm	-	90 kg
	Stroke 300 mm	Stroke 300 mm	-	88 kg
1 axis	Stroke 400 mm	-	-	46 kg
	Stroke 300 mm	-	-	44 kg
	-	-	Stroke 200 mm	40 kg

2.6. Weight

3 Unpacking and handling

3.1. Pre-requisites for reception

Pre-requisites

The check-list below details what must be observed before proceeding with the unpacking and/or installation of the FlexPLP:

	Action	Note
1.	Make sure that only qualified installation personnel conforming to all national and local codes are allowed to perform the installation.	
2.	Make sure that the FlexPLP has not been damaged, by visual inspection.	Specified in *Unpacking and acceptance on page 42*.
3.	Make sure that the lifting device to be used is dimensioned to handle the weight of the FlexPLP.	Specified in *Weight on page 39*.
4.	When these prerequisites have been met, the FlexPLP may be taken to its storage or installation site.	

3.2. Unpacking and acceptance

Before unpacking the unit, quickly check that the package is not damaged, and that the goods are as ordered.

Contents

The content of the delivery package should be detailed on the delivery note.

A standard delivery package generally contains (not including options):

- The FlexPLP
- The SMB box(es) and the cables

Inspection

The FlexPLP is wrapped in a protective bag. Unpack it and check for any visible transport damage. If the FlexPLP is damaged, stop unpacking and contact ABB.

Make sure that all parts of the packing list have been delivered.

Cleaning

If the unit seems to have been contaminated by impurities during the transport, clean them with a clean lint-free cloth.

Identification plate

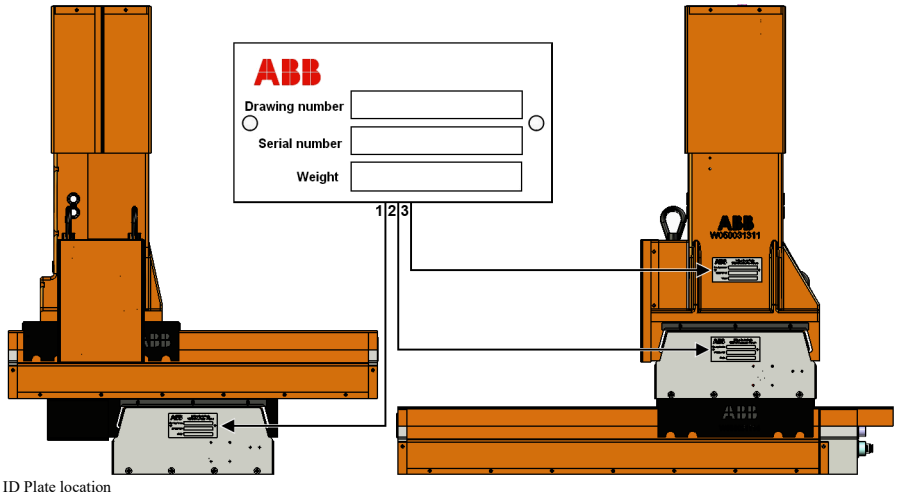
To identify the delivery, read the identification plates and compare them to the delivery note. There is one identification plate per axis, which displays the axis assembly drawing number, the serial number, and the weight.

The serial number is an alpha-numerical combination of the following types:

IRPLP X - 0000 for the first horizontal axis, IRPLP Y - 0000 for the second horizontal axis, and IRPLP Z - 0000 for the vertical axis.

When the IRPLP 050 has more than one axis, the digits are identical on all plates.

The plates can be found on the front and right sides of the IRPLP 050:



ID Plate location

3.3. Handling/lifting

Safety

Before lifting the FlexPLP, read through the safety instructions carefully.

Handling equipment for FlexPLP

Equipment
4 Eye-bolts with a M8 thread 
lifting straps rated for a minimum of 200kg

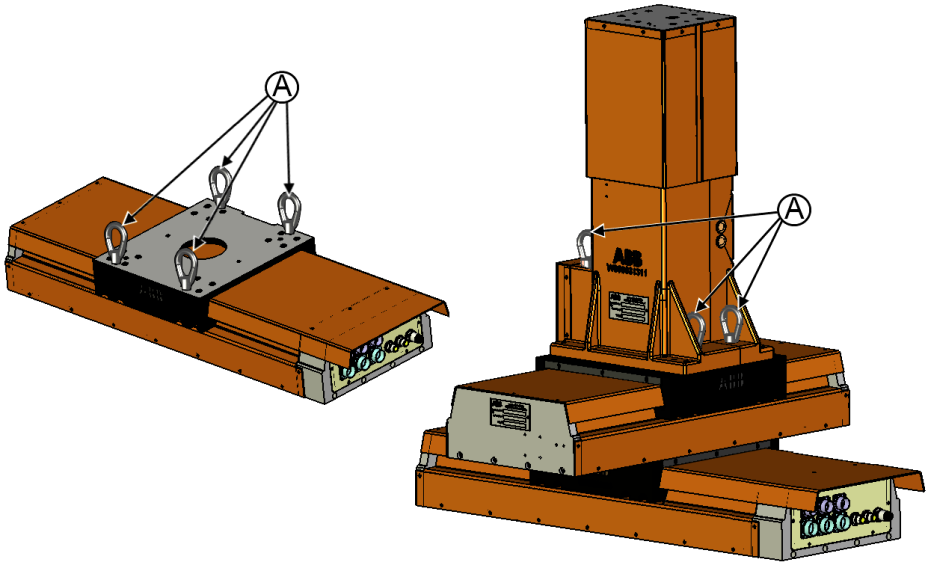
Only use straps for lifting the FlexPLP. Chains could damage the FlexPLP.

Lifting the FlexPLP

Before lifting the IRPLP 050, the carriages of the horizontal axis must be at mid-stroke and the vertical axis must be in low position.

For the dimensions and lifting weight, please refer to *Dimensions on page 35* and *Weight on page 39*.

Tighten the 4 eye bolts (A) to the unit as shown on the following pictures:



Lifting of the IRPLP 050

3.3. Handling/lifting

4 Installation and commissioning

4.1. Introduction

Safety information

Before any service work is commenced, it is important that all safety information is observed! Read *Safety on page 11* before performing any service work.

Required equipment

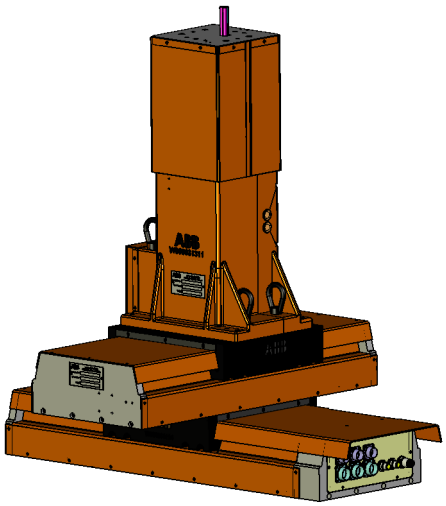
Equipment	Note
Handling equipment	Specified in *Handling/lifting on page 43*.
Standard toolkit	Specified in *Standard toolkit on page 86*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	Specified in *Special tools on page 87*.

Bolts and screws and tightening torques

Specified in *Bolt, screws, tightening torques on page 85*.

Maintenance position

Before proceeding any service work, the PLP must be in maintenance position: horizontal axes carriages at their mid-stroke and vertical axis carriage in low position.



PLP in maintenance position

4.2 Mechanical installation

4.2.1. Surface plate (fastening of the IRPLP 050 to the ground)

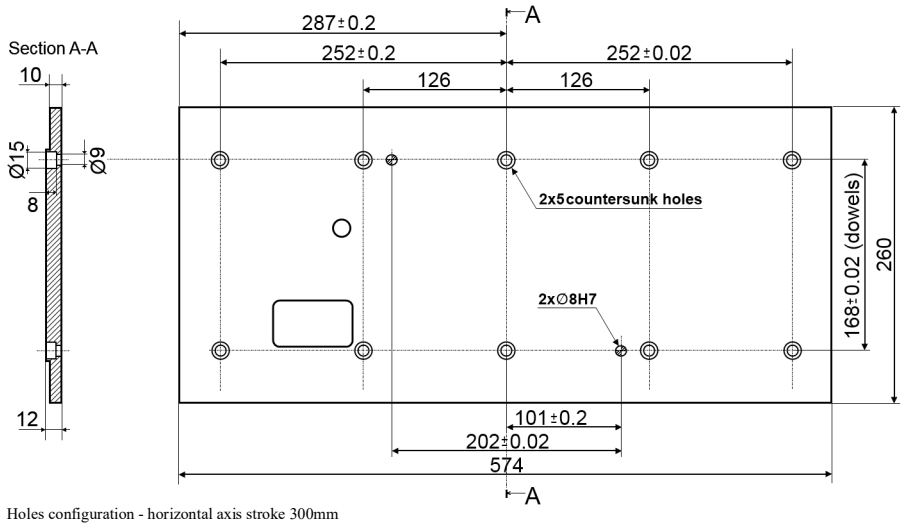
Robustness

The IRPLP 050 must be secured on a surface plate dimensioned to withstand the static loads resulting from the weight of the equipment and the dynamic loads generated by the movements of the carriages and the weight carried. The table below gives the resulting maximum static loads generated by a IRPLP 050 at nominal load:

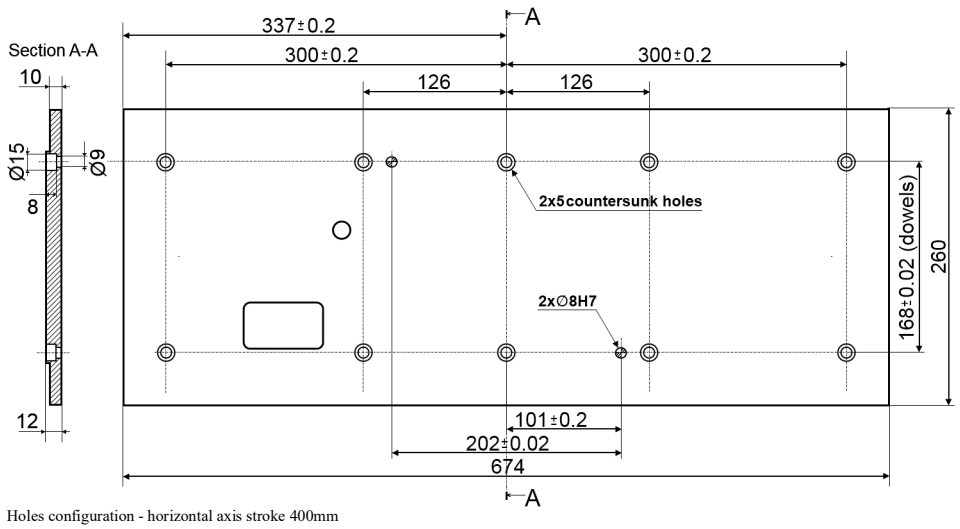
	X axis	Y axis	Z axis
Load	2000 N	2000 N	3000 N

Hole configuration

The figures below show the countersunk and dowel holes prepared in the base plates of the horizontal axis.
The unit must be secured with ten socket head hex screws M8 (ISO 4762) and two 8mm dowel pins.

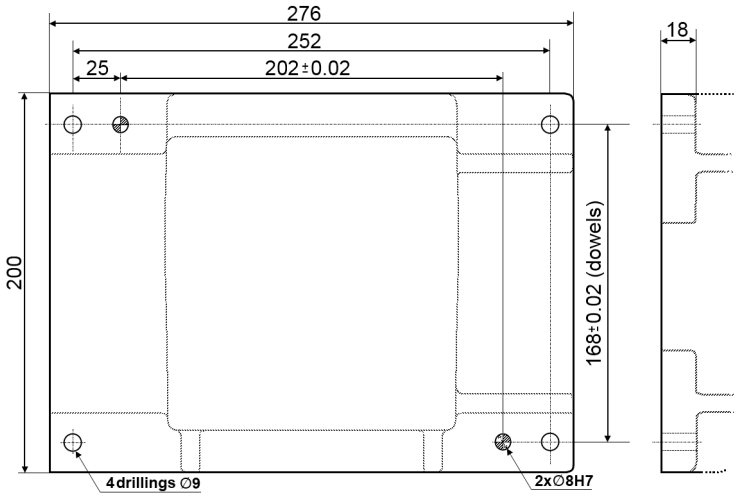


Holes configuration - horizontal axis stroke 300mm



Holes configuration - horizontal axis stroke 400mm

The figure below shows the holes prepared at the base of the vertical axis. The unit must be secured with four socket head cap screws M8 and two 8mm dowel pins.



Holes configuration - vertical axis

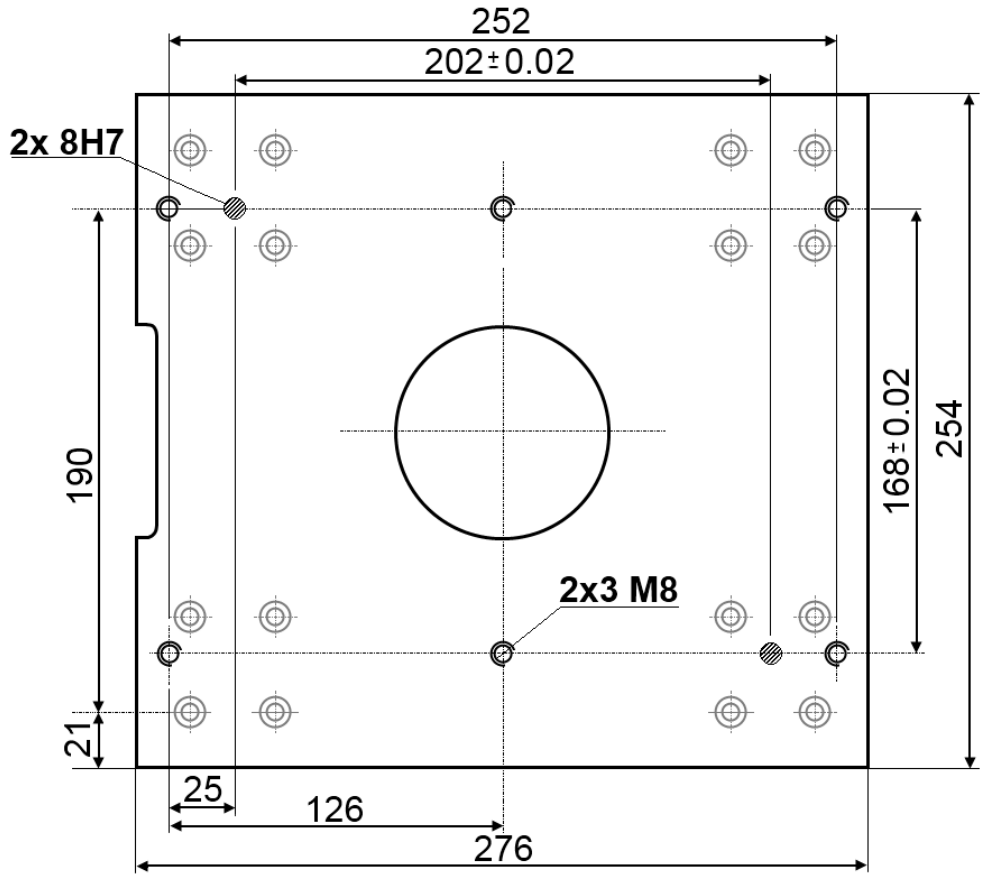
Inclination

The surface plate must be installed horizontally.

4.2.2. Mounting surfaces (fastening of an axis or customer equipment)

IRPLP 050 1 or 2 horizontal axis

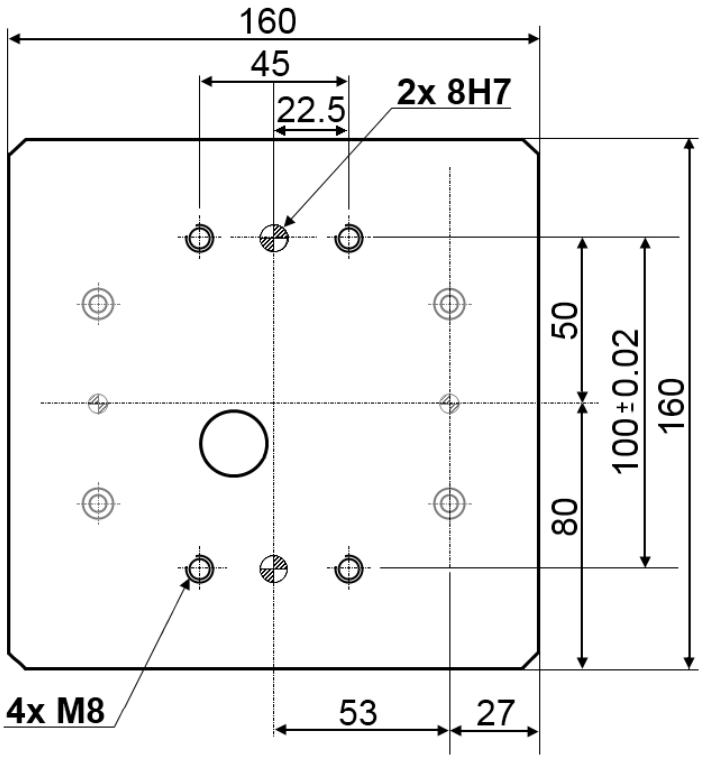
The mounting surface of the horizontal axis carriage includes six M8 holes and two Ø8H7 dowel holes for the fastening of another axis or the customer equipment.



Horizontal carriage

IRPLP 050 with vertical axis

The vertical axis upper plate includes four M8 holes and two Ø8H7 dowel holes for the fastening of the customer equipment.



Vertical carriage

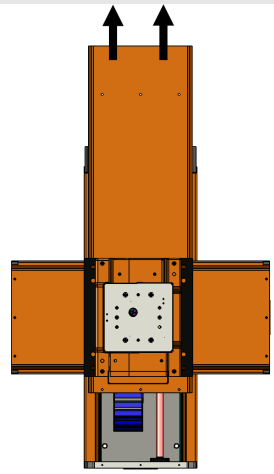
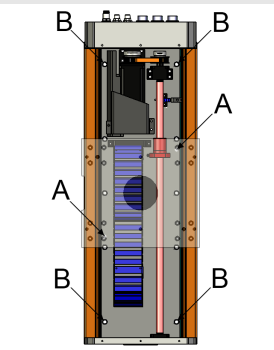
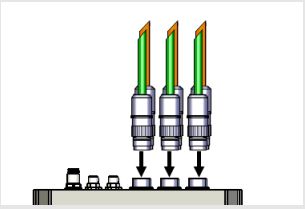
4.2.3. Fastening of a unit to the floor

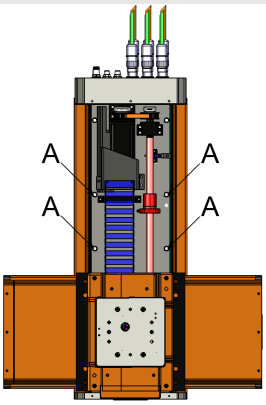
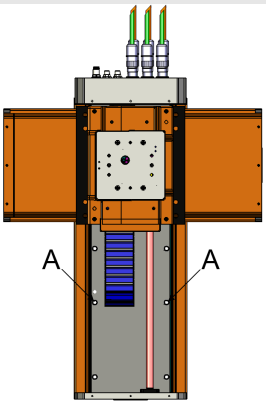
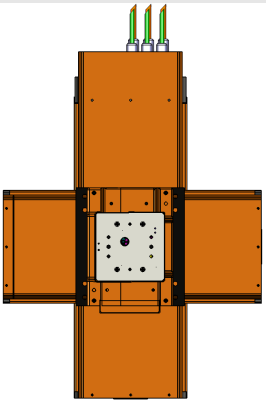
Equipment

The required equipment is the standard toolkit, and in particular:

1.	Hex keys (*Allen* keys) 3 and 6 (socket wrenches recommended)
2.	Torque wrench used with socket head cap 6mm
3.	Two dowel pins Ø8 and ten M8 socket head screws.

Procedure

Steps	Actions	Info/Illustration
1.	As it is necessary to jog the first axis carriage to tighten all the screws, you must prepare the equipment (controller, cables, SMB box) necessary to control the unit. See *Cabling and control on page 52*.)	
2.	Remove the six M4 truss-head screws and slide the upper cover off the first axis.	
3.	Position the unit with the two dowel pins Ø 8mm which holes can be accessed underneath the carriage **(A)**. Tighten the four M8 screws **(B).**	
4.	Connect the power and signal cables to the unit,. if present, connect the customer cables and the pneumatic pipe.	

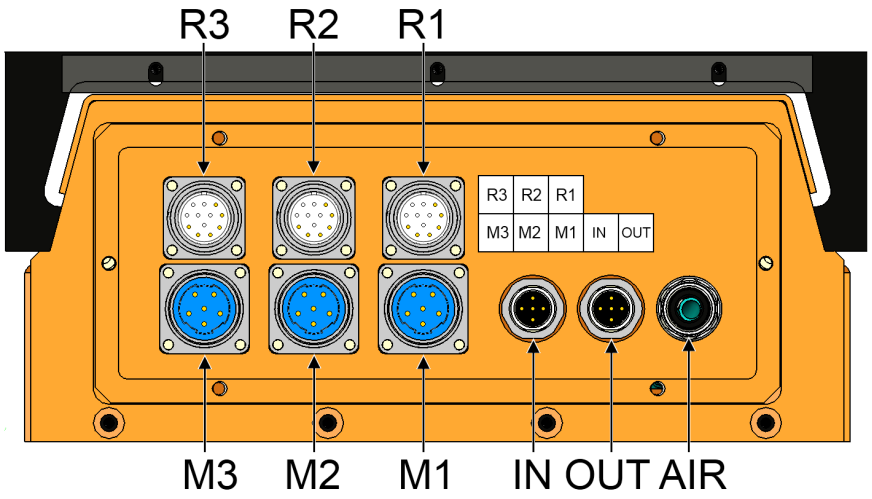
Steps	Actions	Info/Illustration
5.	Use the controller's Teachpendant to move the first axis carriage and clear the access to the four central threaded holes of the base plate **(A)**. Tighten the four M8 screws**.**	
6.	Use the controller to move the first axis carriage and clear the access to the two remaining threaded holes of the base plate **(A)**. Tighten the two M8 screws**.**	
7.	Put the first axis upper cover back in position	

4.3 Cabling and control

4.3.1. Connectors and internal equipment wiring

Connectors

The IRPLP 050 has up to 8 connectors, which functions are indicated on a sticker located on the interface plate:



Connectors

Mark	Specification
R3	Resolver axis 3
R2	Resolver axis 2
R1	Resolver axis 1
M3	Motor power axis 3
M2	Motor power axis 2
M1	Motor power axis 1
IN	M12 plug 5 poles, for customer equipment
OUT	M12 plug 5 poles, for customer equipment
AIR	Pneumatic fitting for tube D8, for customer equipment

Internal harness

The IRPLP 050 integrates an internal harness of one pneumatic tube and 2 electrical cables for the control of customer equipment.
The length that the hose and cables stick out of the vertical axis upper plate is 200mm.

Quantity	Specification
2	Electrical cable, with M12 connector - 5 poles
1	Pneumatic tube PU D8 (in. Ø 6mm, ext. Ø 8mm)

Read *Safety on page 11* before performing any service work.

Wiring diagram

See *Electrical diagrams on page 97*.

4.3.2. Control architecture

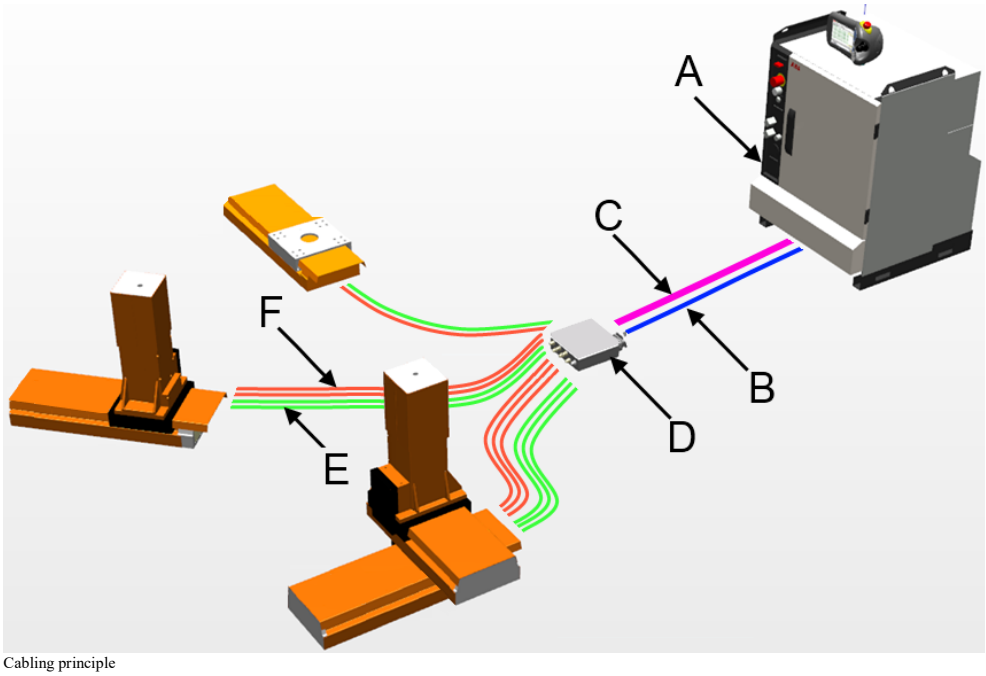
Overview

The IRPLP 050 is driven by the IRC5 through a set of static cables and a SMB box.

The standard control system includes:

- Controller: IRC5 or IRC5 compact (**A**)
  An IRC5 controller can control up to 36 axis, in up to 7 motion tasks. See *Controller capabilities on page 54*.
- Floor resolver cable, IRC5 to SMB. (**B**)
  For IRC5's XS.2 (single cabinet's SMB connection), A4.XS2 (drive module's SMB connection), XS.41 (single cabinet's external axis SMB connection), or A4.XS41 (drive module's external axis SMB connection).
- Floor power cable, IRC5 to SMB (**C**)
  Exists in 2 types:
  - 6 axis type for IRC5's XS.1 (single cabinet's robot power connection) or A4.X1 (drive module's robot power connection)
  - 3 axis type for XS.7 (single cabinet's external axis power connection) or A4.X7 (drive module's external axis power connection).
- SMB Box (**D**)
  Exists in 3 types: 1, 3, or 6 axes
  Equipped with brake release trigger and back-up battery
- IRPLP 050 resolver cable, SMB to PLP (**E**)
  For 1 axis
- IRPLP 050 power cable, SMB to PLP (**F**)
  For 1 axis

Each type of cable is available in a length of 5, 10 or 15m.



Cabling principle

4.3.3. Controller capabilities

General

Depending on its configuration, an IRC5 controller with one drive module can control up to nine axes: six axis controlled by the Main Drive Unit (MDU) and up to three axis controlled by the Additional Drive Units (ADU). Up to three additional drive modules can be added to the controller, for a total of four drive modules, i.e., up to thirty-six axes. Read *3HAC021313 - Product Manual, IRC5 Controller.*

Furthermore, a controller with MultiMove system can manage up to six motions tasks, regardless of the number of drive modules. This means that if the system configuration has more that six IRPLP050, two or more units must be grouped in one motion task. Read 3HA021395 - Additional axes and stand alone controller.

On one drive module, the axes of one IRPLP 050 unit shouldn't be controlled across the MDU (six first drive units) and the ADU (up to three drive units). For example, a 3 axis IRPLP 050 should not have two axes controlled by the MDU and one axis controlled by one of the ADU.

Robot controller requirements

IRPLP 050 axes are controlled by ABB IRC5 robot controller as additional axes.

IRPLP050 is designed to perform with optimal performance when used with a drive type 58A 262V (IRC5's option 751-1) or with a drive type 144A 400-480V (IRC5's option 751-5).

Requirements for the controller - system without manipulator

The controller equipment must fulfill the following requirements to integrate a FlexPLP IRPLP050.

Note that the following configuration is also suitable for a system with FlexLifter and FlexTrack:

Option no.	Type	Description
435-99	Variant	No IRB manipulator
751-1	Drive system	58A 262V
751-5	Drive system	144A 400-800V
604-2	Option	MultiMove Independent Note: 884-1(MultiMove without robot) is required if the IRC5 is equipped with the main computer DSQC639.
608-1	Option	World Zones
611-1	Option	Path Recovery
613-1	Option	Collision Detection

Configurations: fully occupied drive module

Below are all the configurations in which all of the axes of one drive module are occupied:

	Main Drive Unit						Additional Drive Units			
#	Drive 1	Drive 2	Drive 3	Drive 4	Drive 5	Drive 6	Drive 7	Drive 8	Drive 9	PLP

1	PLP 3 axis				PLP 3 axis				PLP 3 axis			3
2	PLP 3 axis				PLP 3 axis				PLP 2 axis		PLP 1 axis	4
3	PLP 3 axis				PLP 3 axis				PLP 1 axis	PLP 1 axis	PLP 1 axis	5
4	PLP 3 axis				PLP 2 axis		PLP 1 axis		PLP 3 axis			4
5	PLP 3 axis				PLP 2 axis		PLP 1 axis		PLP 2 axis		PLP 1 axis	5
6	PLP 3 axis				PLP 2 axis		PLP 1 axis		PLP 1 axis	PLP 1 axis	PLP 1 axis	6
7	PLP 3 axis				PLP 1 axis	PLP 1 axis	PLP 1 axis		PLP 3 axis			5
8	PLP 3 axis				PLP 1 axis	PLP 1 axis	PLP 1 axis		PLP 2 axis		PLP 1 axis	6
9	PLP 3 axis				PLP 1 axis	PLP 1 axis	PLP 1 axis		PLP 1 axis	PLP 1 axis	PLP 1 axis	7[1)]
10	PLP 2 axis		PLP 2 axis		PLP 2 axis				PLP 3 axis			4
11	PLP 2 axis		PLP 2 axis		PLP 2 axis				PLP 2 axis		PLP 1 axis	5
12	PLP 2 axis		PLP 2 axis		PLP 2 axis				PLP 1 axis	PLP 1 axis	PLP 1 axis	6
13	PLP 2 axis		PLP 2 axis		PLP 1 axis	PLP 1 axis			PLP 3 axis			5
14	PLP 2 axis		PLP 2 axis		PLP 1 axis	PLP 1 axis			PLP 2 axis		PLP 1 axis	6
15	PLP 2 axis		PLP 2 axis		PLP 1 axis	PLP 1 axis			PLP 1 axis	PLP 1 axis	PLP 1 axis	7[1)]
16	PLP 2 axis		PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis			PLP 3 axis			6
17	PLP 2 axis		PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis			PLP 2 axis		PLP 1 axis	7[1)]
18	PLP 2 axis		PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis			PLP 1 axis	PLP 1 axis	PLP 1 axis	8[1)]
19	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis			PLP 3 axis			7[1)]
20	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis			PLP 2 axis		PLP 1 axis	8[1)]
21	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis	PLP 1 axis			PLP 1 axis	PLP 1 axis	PLP 1 axis	9[1)]

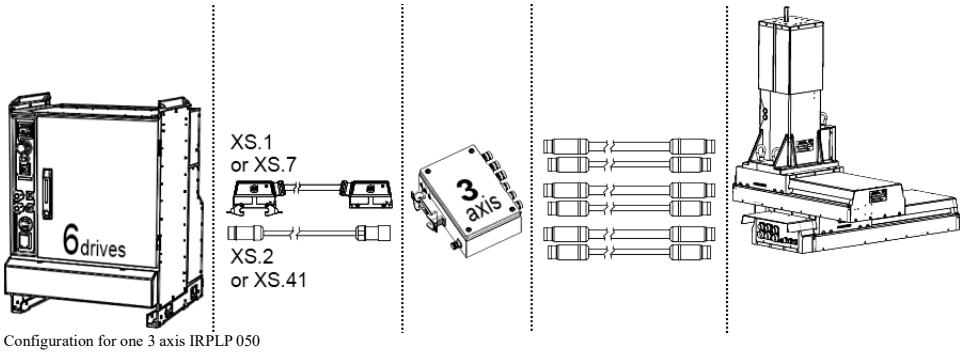
[1)]Configuration in which two or more mechanical units must be grouped in one motion task.

4.3.4. Examples of configurations

System example: One 3 axis IRPLP 050

Below is an example of configuration with one single cabinet IRC5 which controls one 3 axis IRPLP 050 through one 3 axis SMB box.

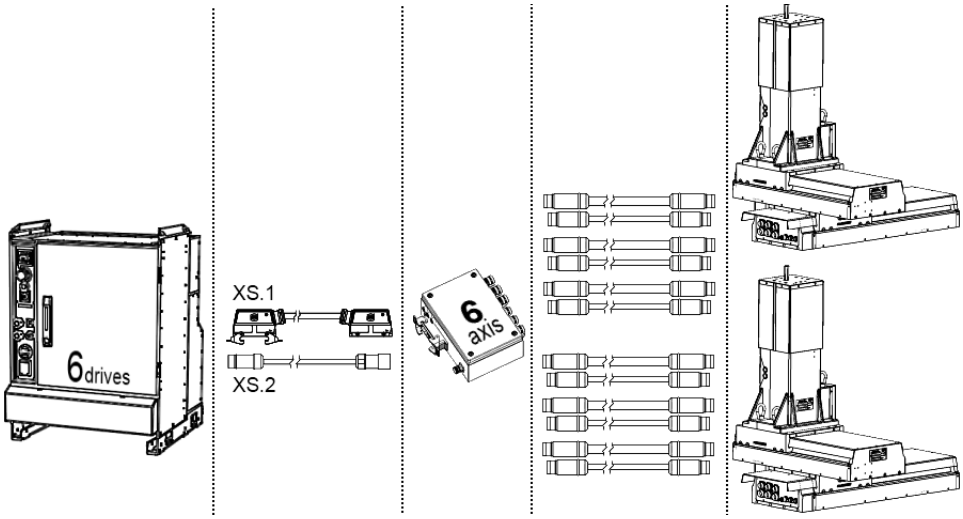
Note that if the controller's XS.1 and XS.2 are already occupied, and if the number of drive units in the controller is enough for all the mechanical units, it is possible to use a power cable for IRC5's XS.7 (3 axis) and a signal cable for XS.41.



Configuration for one 3 axis IRPLP 050

System example: Two 3 axis IRPLP 050

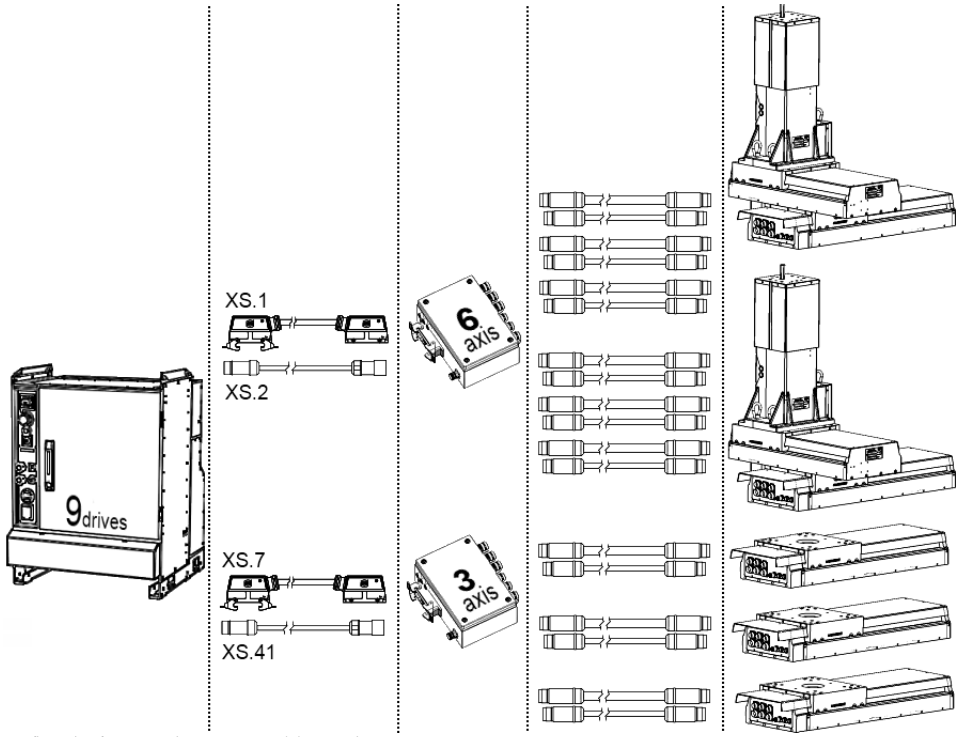
Below is an example of configuration with one single cabinet IRC5 which controls two 3 axis IRPLP 050 through one 6 axis SMB box.



Configuration for two 3 axis IRPLP 050

System example: Two 3 axis IRPLP 050 and three 1 axis IRPLP 050

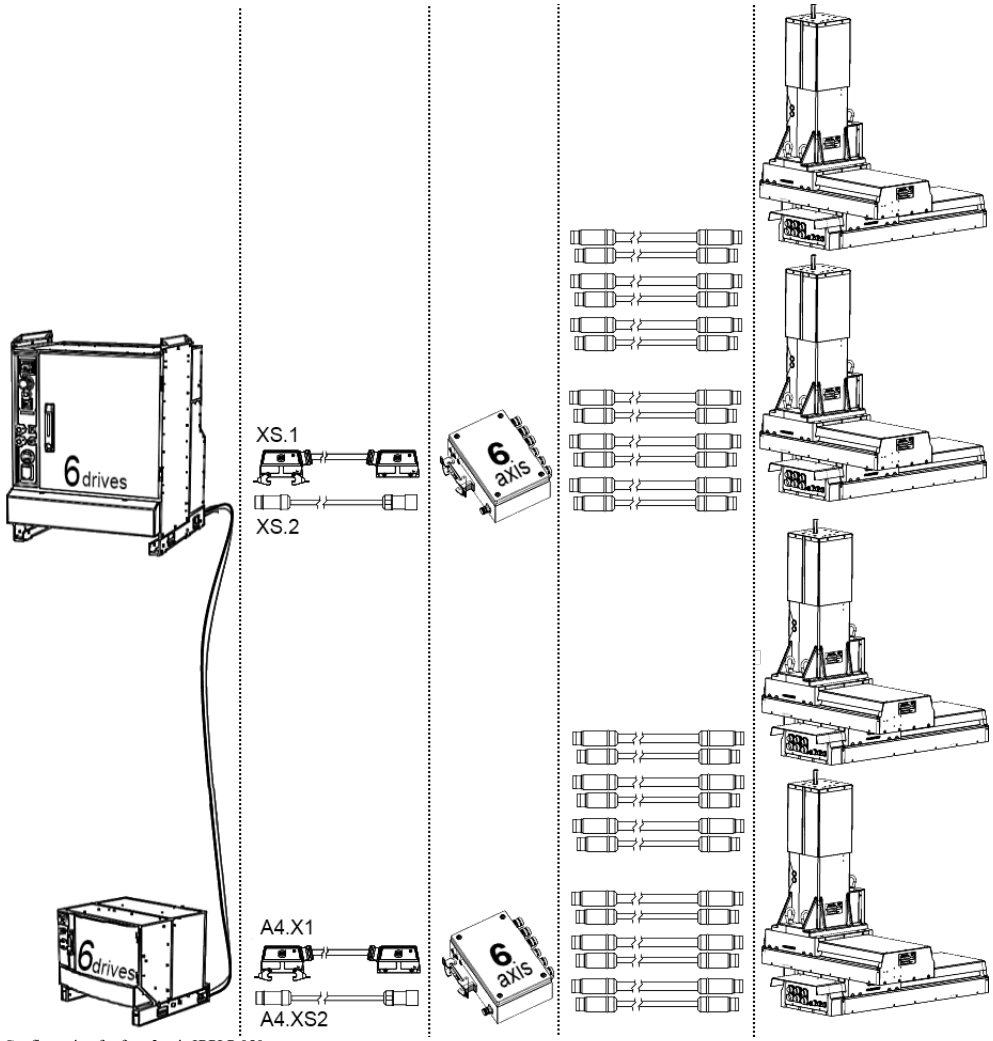
Below is an example of configuration with one single cabinet IRC5 (with nine drive units) which controls two 3 axis IRPLP 050 and three 1 axis IRPLP 050 through respectively one 6 axis SMB box and one 3 axis SMB box.



Configuration for two 3 axis IRPLP 050 and three 1 axis PLP

System example: Four 3 axis IRPLP 050 and three 1 axis IRPLP 050

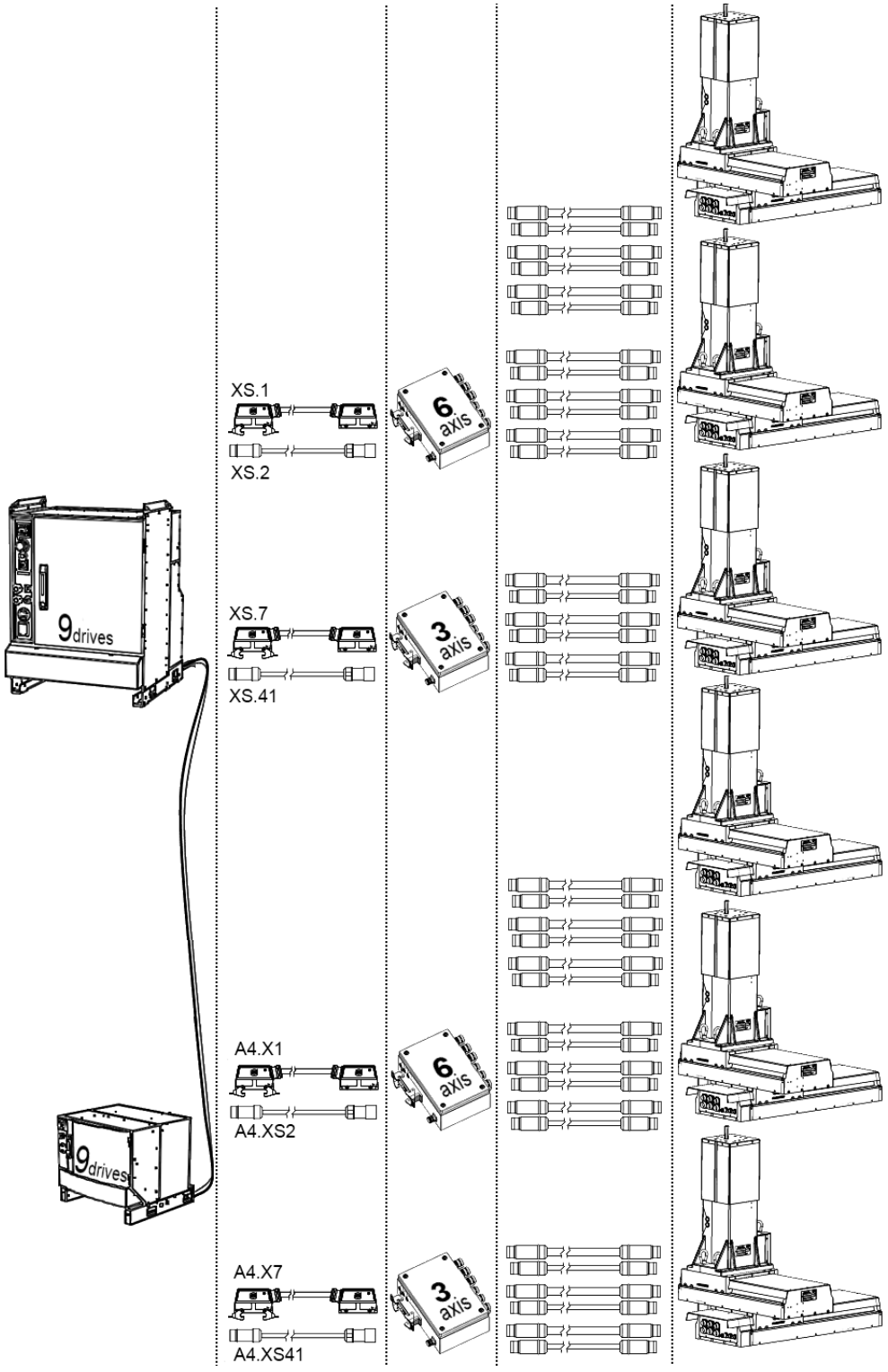
Below is an example of configuration with one IRC5 (with six drive units) equipped with one additional drive module (also with six drive units), connected with one ethernet cable and one safety cable. The IRC5 controls four 3 axis IRPLP 050 through two 6 axis SMB box.



Configuration for four 3 axis IRPLP 050

System example: Six 3 axis IRPLP 050

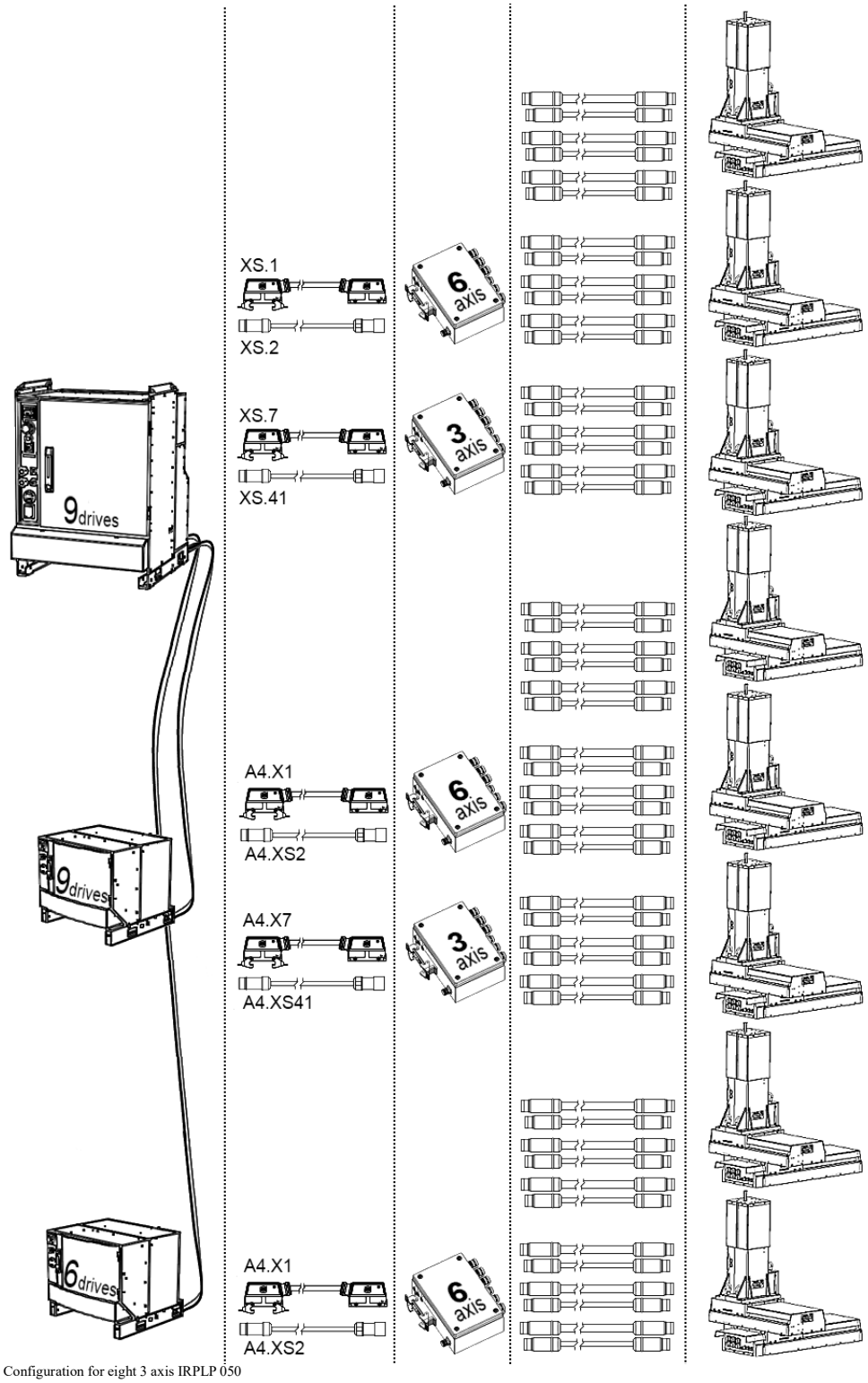
Below is an example of configuration with one IRC5 (with nine drive units) equipped with one additional drive module (also with nine drive units). The IRC5 controls six 3 axis IRPLP 050 through two 6 axis SMB box, and two 3 axis SMB box.



Configuration for six 3 axis IRPLP 050

System example: Eight 3 axis IRPLP 050

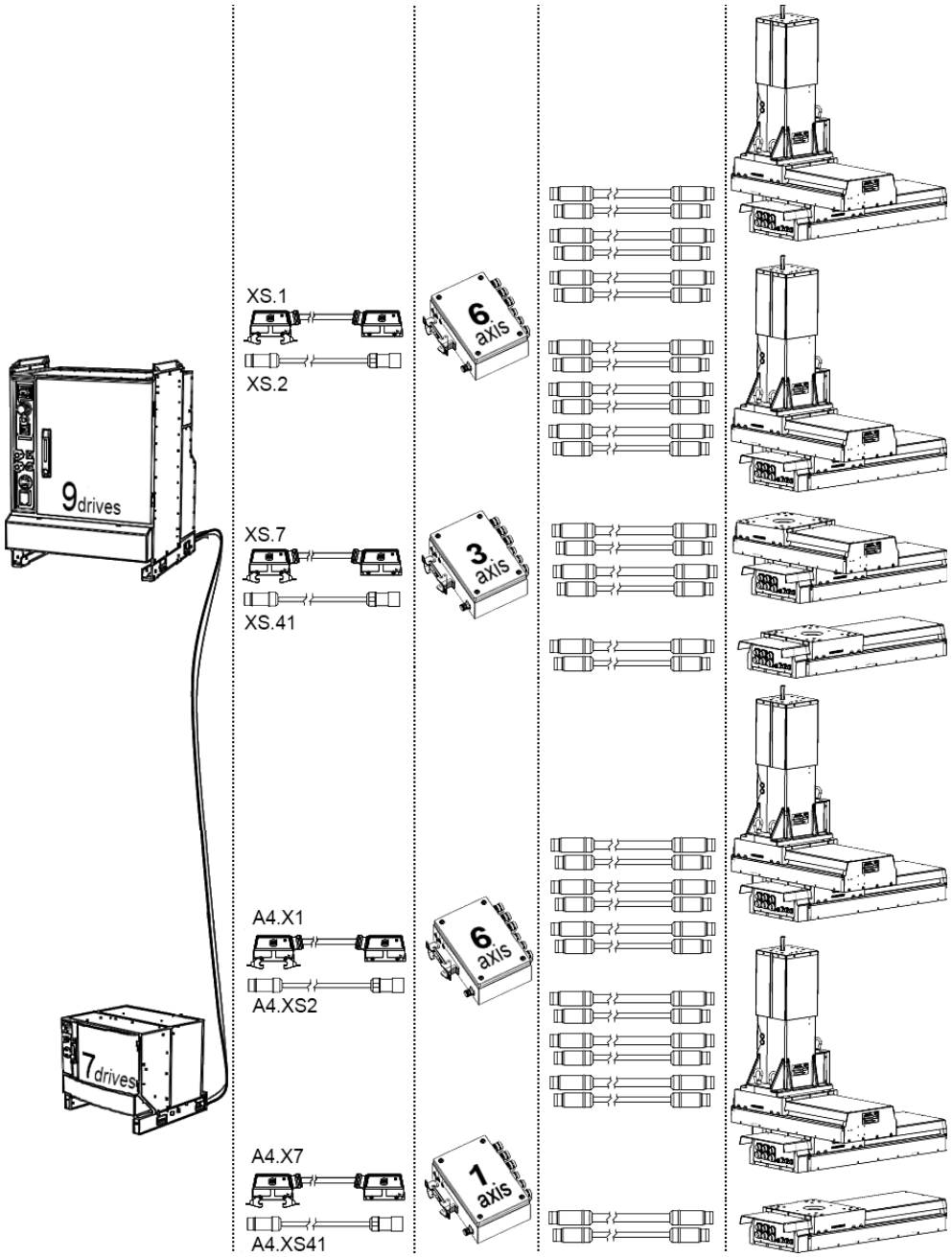
Below is an example of configuration with one IRC5 (with nine drive units) equipped with two additional drive module (one with nine drive units and the other one with six drive units), connected with two ethernet cables and two safety cables. The IRC5 controls eight 3 axis IRPLP 050 through three 6 axis SMB box, and two 3 axis SMB box. Since the system has eight IRPLP 050, three mechanical units or more are grouped in two motion tasks or more.



Configuration for eight 3 axis IRPLP 050

System example: Four 3 axis IRPLP 050, one 2 axis IRPLP 050, and two 1 axis IRPLP 050

Below is an example of configuration with one IRC5 (with nine drive units) equipped with one additional drive module (with seven drive units). The IRC5 controls four 3 axis IRPLP 050, one 2 axis IRPLP 050, and two 1 axis IRPLP 050 through two 6 axis SMB box, one 3 axis SMB box, and one 1 axis SMB box. Since the system has seven IRPLP 050, two mechanical units or more are grouped in one motion task or more.



Configuration for four 3 axis IRPLP 050, one 2 axis IRPLP 050, and two 1 axis IRPLP 050

4.3.5. Configuration files

Overview

In order for the controller to identify that the FlexPLP exists and to control it, configuration files must be loaded into the IRC5 system.

Two files need to be set:

- The Motion Control file: MOC.cfg
- The System file: SYS.cfg

The Motion control file is provided with the product.

The system file should be set depending on your existing system and the layout.

Detailed instructions regarding the setting and loading of these files can be found in the controller documentation. Read *3HAC021313-001 - Product manual,IRC5 Robot Controller*; *3HAC035738-001 - Product Manual, IRC5 Compact* and *3HAC16590-1 - Operating manual, IRC5 with FlexPendant*

Once the parameters are properly set in the system, calibrate the unit(s) as described in *Calibration information on page 63.*

5 Calibration information

5.1. Introduction / When to calibrate

General

This chapter includes general information and detailed procedures about the calibration methods: The fine calibration and the update of the revolution counters.

For more information about the operation of IRC5 based robot systems using a FlexPendant, read 3*HAC16590 - Operating manual, IRC5 with FlexPendant* and *Operating manual, Calibration Pendulum*.

When to perform a fine calibration

The fine calibration of the FlexPLP must be done at the first commissioning or after the replacement of mechanical parts such as:

- Servomotor
- Timing belt or pulley
- Ballscrew
- Replacement of a complete axis

A 20mm shim is required to perform the fine calibration.

When to update the revolution counters

The FlexPLP axis must be calibrated each time the contents of the revolution counter are changed or lost. This will occur when:

- The battery is discharged
- A resolver error occurs
- The signal between a resolver and measurement board is interrupted (e.g., cable disconnected)
- A robot axis is moved with the control system disconnected

The revolution counters must also be updated after the robot and controller are connected at the first installation.

Power failure

There's no need to calibrate the FlexPLP after a power failure, the backup battery included in the SMB box will store the resolver position until power is restored.

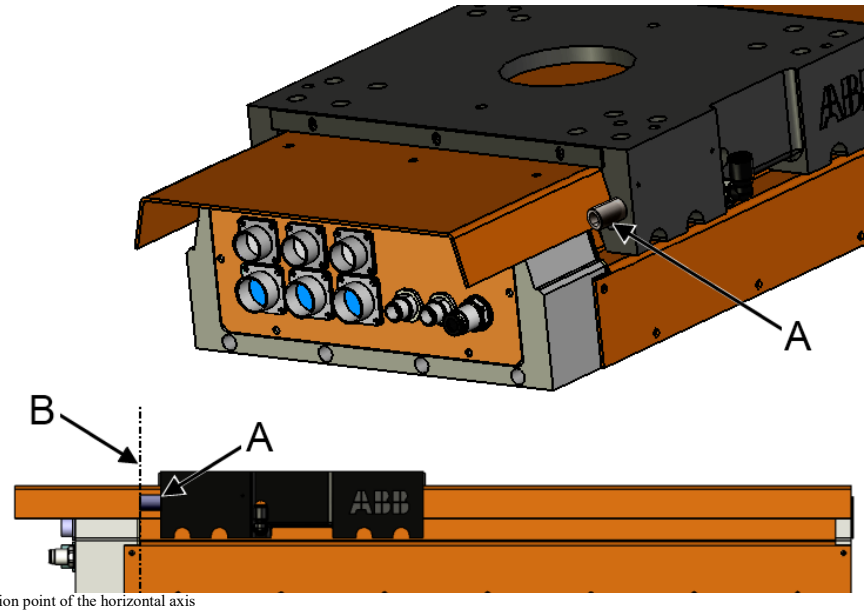
Precautions

- If an axis is incorrectly calibrated or if the revolution counter is incorrectly updated, it will cause incorrect positioning, which in turn may cause damage or injury! Check the calibration position very carefully after each update.
- Before any service work, make sure that nobody stands near the mechanical unit when the carriage moves, and make sure that no object which could get in the way of the carriage or jam between the carriage and the covers.

5.2. Calibration points

Calibration point, horizontal axis

The calibration point is located 20 mm before the mechanical limit, on the motor side of the axis. It is reached when the calibration marker of the carriage is aligned with the edge of the side flange.

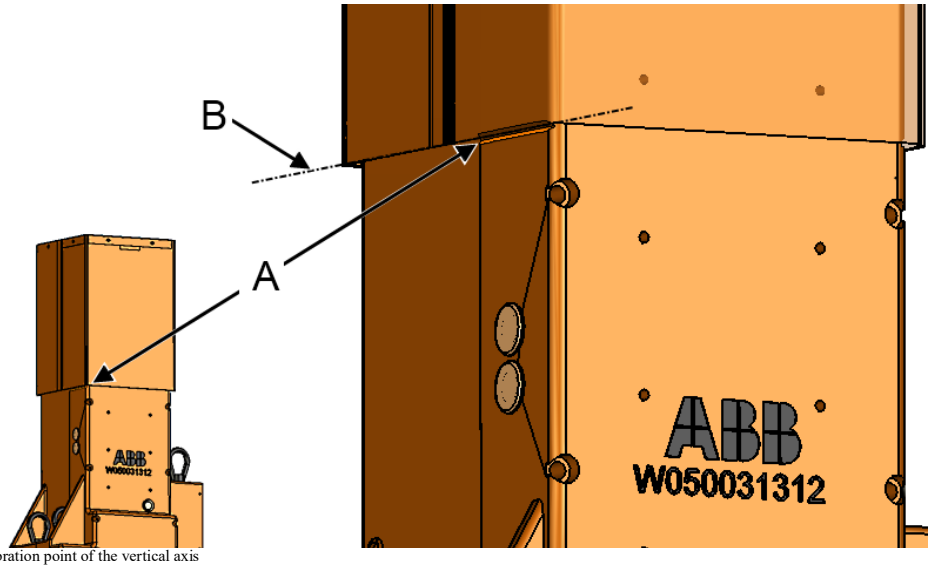


Calibration point of the horizontal axis

A	Calibration marker
B	Alignment of the calibration marker end and the side flange edge

Calibration point, vertical axis

The calibration point is located 20 mm before the lower mechanical limit. It is reached when the bottom edge of the carriage cover is aligned with the calibration mark on the axis body.



Calibration point of the vertical axis

A	Calibration mark
B	Alignment of the calibration mark and the cover lower edge

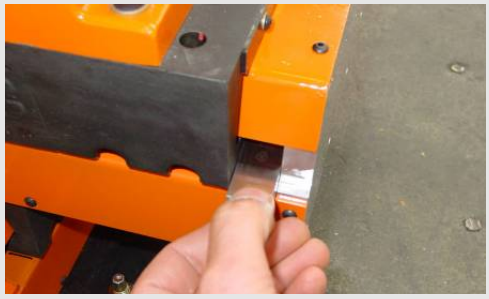
5.3. Fine calibration

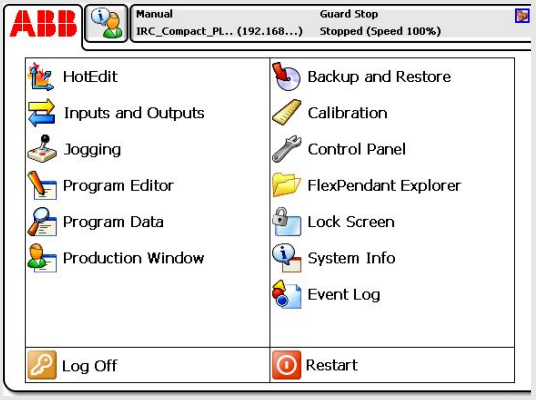
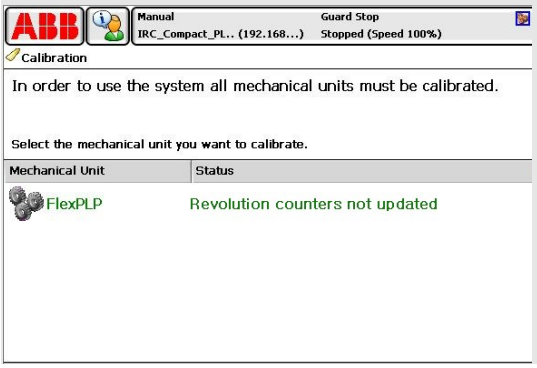
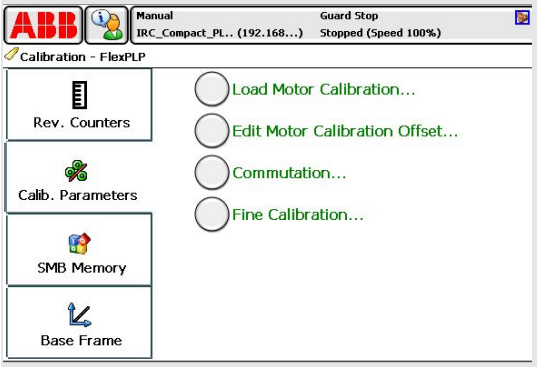
Calibration shim

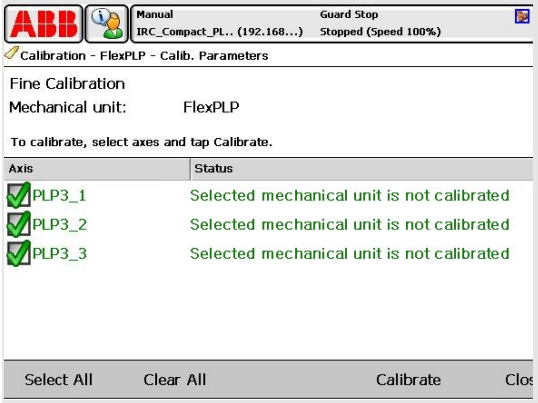
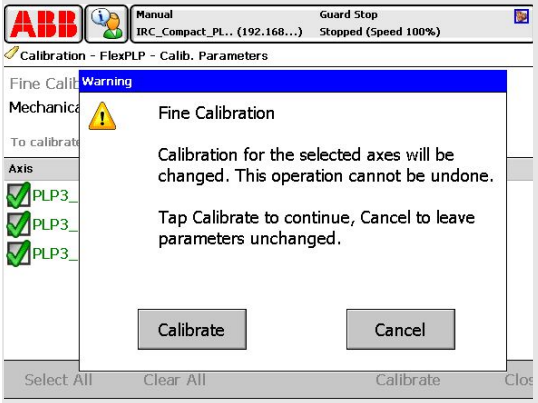
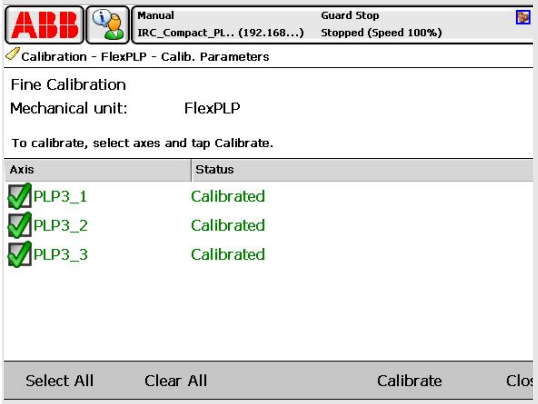
The fine calibration of the FlexPLP must be done with a 20mm calibration shim.

You can order a calibration shim from ABB under the reference number 3HAW050008818.
See *Special tools on page 87*

Procedure

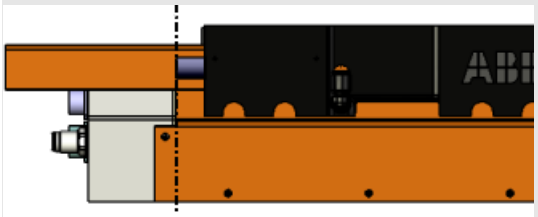
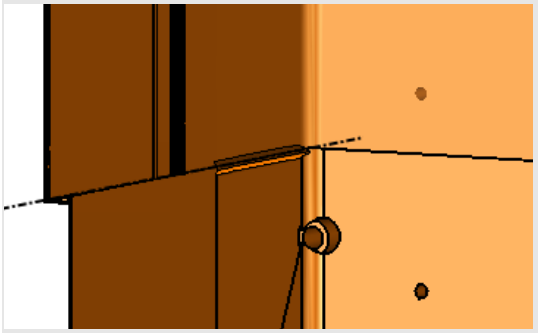
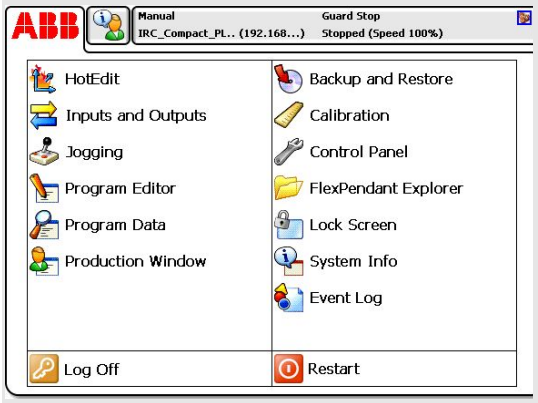
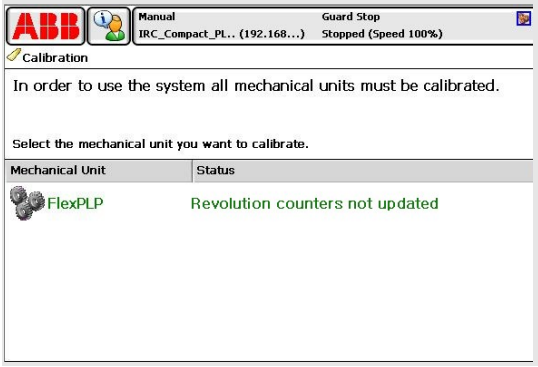
Steps	Action	Info/Illustration
1.	Using the FlexPendant, jog the carriage close to the calibration point.	
2.	If the fine calibration of the vertical axis is needed, remove the axis covers.	
3.	Use the shim to jog the carriage precisely at the calibration point.	 First axis calibration  Second axis calibration  Third axis calibration

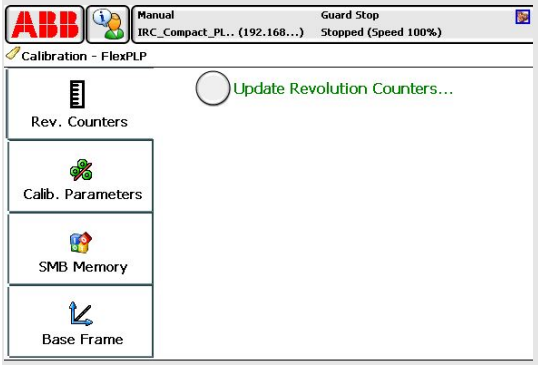
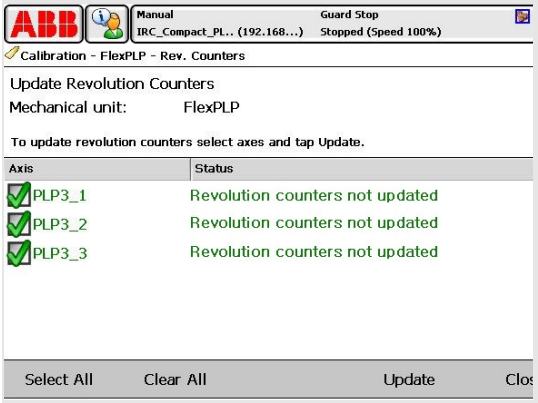
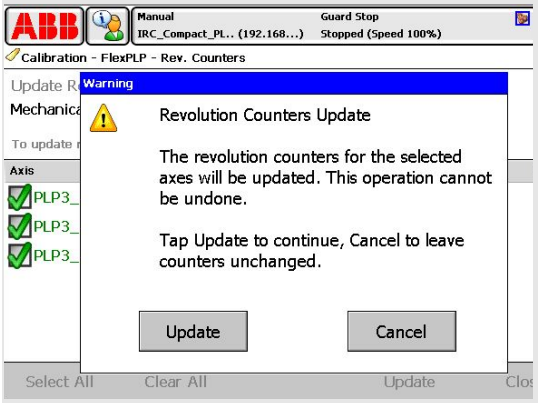
Steps	Action	Info/Illustration
4.	On the FlexPendant, tap on the **ABB** logo to access the ABB menu and tap on **Calibration**.	
	All mechanical units connected to the system are shown along with their calibration status.	
5.	Tap to select the mechanical unit and then tap to select the tab **Calib. Parameters.** Tap **Fine Calibration...** A dialog box is displayed, urging you to use external equipment to performing the actual calibration. A warning that updating the revolution counters can change programmed robot positions is also displayed. Tap **Yes** to proceed.	

Steps	Action	Info/Illustration
6.	Select the check-box for the axis to calibrate.	
7.	Tap **Calibrate**. A dialog box is displayed, warning that calibration of the selected axes will be changed, which cannot be undone: • Tap **Calibrate** to proceed. • Tap **Cancel** to cancel. Tapping **Calibrate** results in briefly displaying a dialog box, announcing that the calibration process has started.	
8.	The axis is calibrated and the system returns to the list of available mechanical units.	

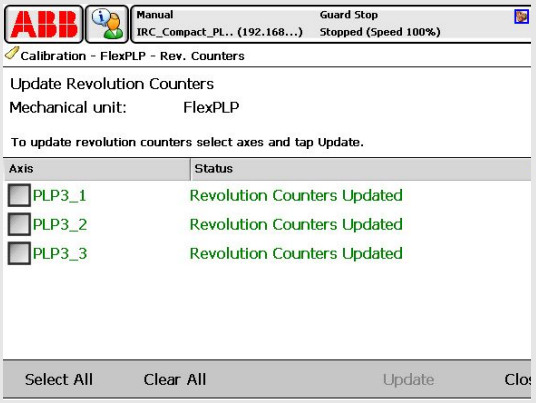
5.4. Update of the revolution counters

Procedure

Steps	Action	Info/Illustration
1.	Using the FlexPendant, jog the carriage to the calibration point.	 Calibration point, horizontal axis  Calibration point, vertical axis
2.	On the FlexPendant, tap on the **ABB** logo to access the ABB menu and tap on **Calibration**. All mechanical units connected to the system are shown along with their calibration status.	 

Steps	Action	Info/Illustration
3.	Tap to select the mechanical unit and then tap to select the tab **Rev. Counters** Tap **Update Revolution counters...** A dialog box is displayed, warning that updating the revolution counters may change programmed robot positions: tapping **Yes** displays the axis selection window.	
4.	Select the axis to have its revolution counter updated by: • Ticking in the box to the left • Tapping **Select all** to update all axes. Then tap **Update**.	
5.	Tap **Update**. A dialog box is displayed, warning that calibration of the selected axes will be changed, which cannot be undone: • Tap **Calibrate** to proceed. • Tap **Cancel** to cancel.	

5.4. Update of the revolution counters

Steps	Action	Info/Illustration
6.	Tapping **Update** updates the selected revolution counters and removes the tick from the list of axes.	

6 Maintenance

6.1. Introduction

General

This chapter details all maintenance activities recommended for the FlexPLP.

It is based on the maintenance schedule, located in the beginning of the chapter. The schedule contains information about required maintenance activities including intervals and refers to procedures for the activities. Each procedure contains all information required to perform the activity, e.g., required tools and materials. The procedures are gathered in different sections, divided according to the maintenance activity.

Safety information

Before any service work is commenced, it is extremely important that all safety information is observed! There are general safety aspects that must be read through, as well as more specific safety information that describe danger and safety risks when performing the procedures. Read *Safety on page 11* before performing any service work.

Precautions

The precautions below should be observed before proceeding with the maintenance of the FlexPLP:

- Before any intervention on the mechanical and electrical components, all power supplies to the FlexPLP as well as to other machines within the danger zone must be turned off.
- If required, the main switch should be locked.
- Make sure that the pneumatic system is not pressurized.
- Use only original ABB spare parts. The use of unauthorized parts or others than original parts will void the warranty.

Required equipment

Equipment	Note
Handling equipment	Specified in *Handling/lifting on page 43*.
Standard toolkit	Specified in *Standard toolkit on page 86*.
Other tools and procedures may be required. See references to these procedures in the step-by-step instructions below.	Specified in *Special tools on page 87*.

Bolts and screws and tightening torques

Specified in *Bolt, screws, tightening torques on page 85*.

6.2. Maintenance planning

Even though the FlexPLP is designed to require few maintenance operations, it is important to check the points mentioned hereafter and follow the maintenance time intervals and instructions.

Time interval	Item	Maintenance	More info.
Every year	General condition	Covers removed, inspect the condition of the unit and clean it thoroughly.	*Inspection on page 73*.
	Cables and connectors	Look for wearing or damages.	
	Internal cable chains	Look for wearing or damages.	
	Linear guideways and ball bearings blocks	Inspect, clean, and lubricate	*Lubrication on page 74*.
	Ball screw	Inspect, clean, and lubricate	
	Timing belt	• Look for premature wearing. • Measure the belt tension and adjust it if necessary. • Replace the belt in case of apparent damage.	*Timing belt (tension check, adjustment and replacement) on page 76*.
Every 3 years	SMB box back-up battery	Replace the battery	*SMB Battery pack replacement on page 79*.

6.3. Inspection

General

A thorough inspection of the FlexPLP should be done at least once a year.

All covers removed, clean the unit with a lint free cloth.

Before any intervention on the mechanical and electrical components, all power supplies to the IRPLP 050 as well as to other machines within the danger zone must be turned off.

Remember to go first through the inspections that require the system to be live (e.g., test of all electrical functions and search for abnormal noise).

Emergency stop

To check the emergency stop function, the unit must be stationary. Press the emergency stop button and perform the procedure for restart after an emergency stop as detailed in the controller documentation.

Electrical functions

Test all the electrical functions.

Make sure that each carriage can reach the limits of its stroke.

Abnormal noise

Look for any abnormal noise, e.g., bearing noise.

Cables

Inspect all cables. If a cable is damaged due to wear or pinching, replace it. If a cable seems to rub against sharp edges, extend the cable so that it hangs freely.

Contacts

Make sure that all plugs are properly connected and that there is no play.

Cable chain

Check the condition of the cable chain and in particular the state of the mechanical links and the fastening points (carriage and base plate).

6.4. Lubrication

General

Each axis of the IRPLP 050 has 5 lubrication points: On the four ball bearings block, and on the ballscrew nut.

The unit is lubricated in factory, therefore no lubrication is required upon commissioning.

Use lithium soap grease, class NLGI 0, with a mineral oil base, doped with EP (extreme pressure) additives. The base oil viscosity must be ISO VG68 to ISO VG 100.

Grease doped with EP additives is absolutely necessary, due to high loads on blocks.

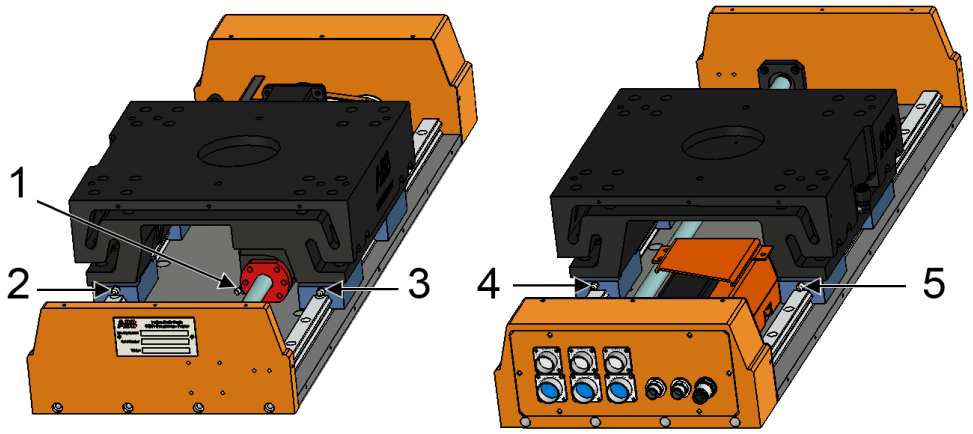
Equipment	Note
Lubricant	CASTROL Longtime PD0
Lubricant	KLÜBER Microlube GB0 The grease used causes serious eye irritation and may cause an allergic skin reaction.
Lubricant	TOTAL Multis EP 0

Lubrication horizontal axis

To access the lubrication ports of the horizontal axis, make sure that the carriage is in maintenance position (mid-stroke) and remove the upper and side covers.

If necessary, clean the ballscrew and/or the linear guides with a lint-free cloth and slightly lubricate them with a brush.

Use a manual pump to inject grease in the five nipples.



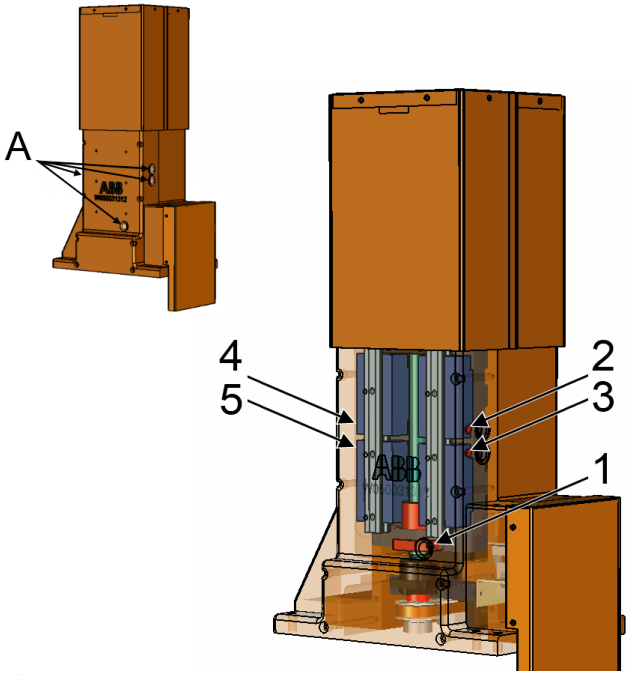
Lubrication ports horizontal axis

Port 1	Nut of the ball screw
Ports 2-5	Ball bearing blocks

Lubrication vertical axis

To access the lubrication ports of the vertical axis, make sure that the carriage is in maintenance position (low position) and remove the five plugs. No cover needs to be removed.

Use a manual pump to inject grease in the five nipples.



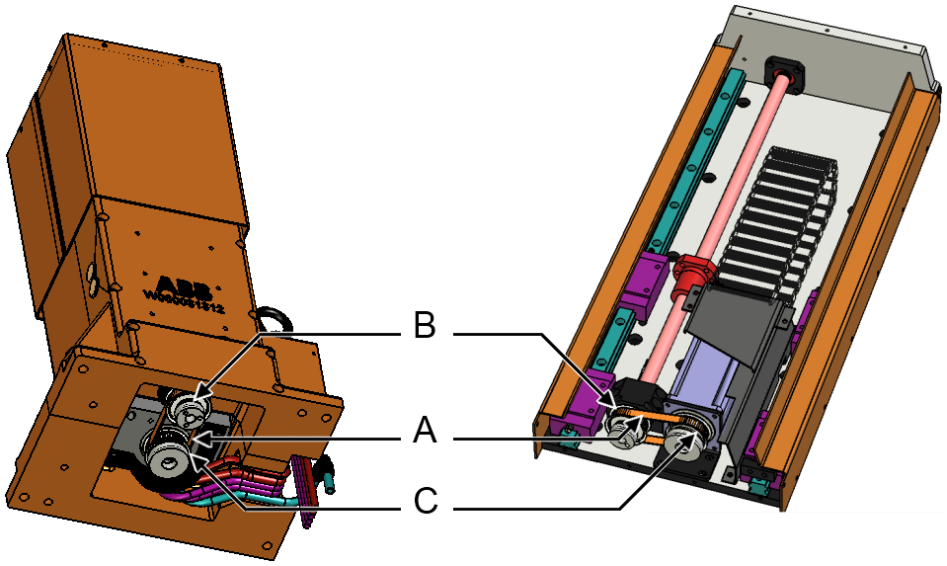
Lubrication ports vertical axis

A	Lubrication port plugs
Port 1	Nut of the ball screw
Ports 2-5	Ball bearing blocks

6.5. Timing belt (tension check, adjustment and replacement)

Inspection

To inspect the timing belt of an horizontal axis, remove the upper cover.
To inspect the belt of a vertical axis, it is necessary to remove the axis from the horizontal axis or surface place to which it is attached.



Location of the timing belt

A	Timing belt
B	Ball screw shaft pulley
C	Motor shaft pulley

Wearing of the belt is normal and the presence of a reasonable quantity of black dust should not be alarming. If however the belt shows signs of advanced wearing, it should be replaced (see *Spare parts on page 89*).
In any case, you should measure the tension of the belt and, if necessary, adjust it.

Tension of the belt

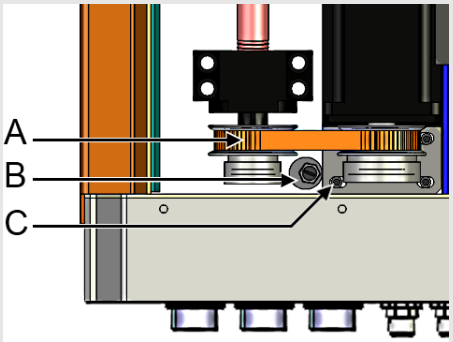
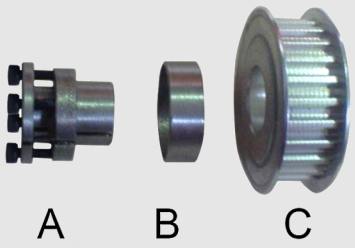
The easiest and most reliable method to measure the belt tension is to use a tension gauge with an optical resonance frequency meter, such as the *Continental CONTITECH VSM-1*.

Below is the correct value for the belt tension:

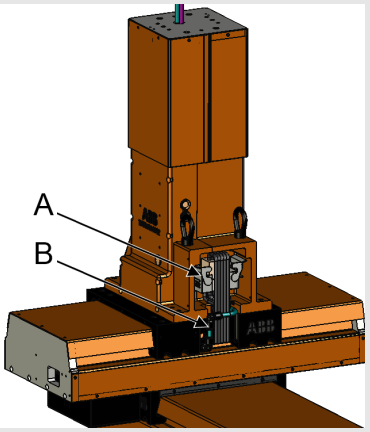
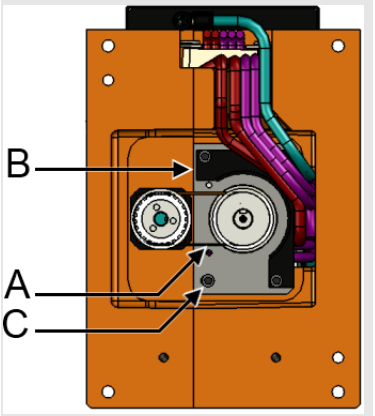
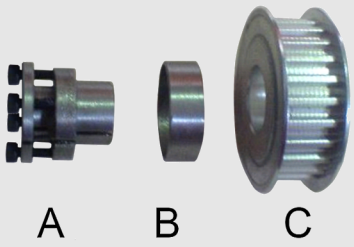
Belt resonance frequency	220 Hz ± 20Hz

You can order a tension gauge (*Continental CONTITECH VSM-1*) from ABB under the reference number 3HAW050009048. See *Special tools on page 87*

Adjustment or replacement of the belt, horizontal axis

Steps	Actions	Info/Illustration
1.	The IRPLP 050 must be in maintenance position (horizontal carriage at mid-stroke)	
2.	Remove the upper cover to clear the access to the belt.	
3.	Measure the tension of the belt (**A**), preferably with a tension gauge. If the tension is out of range, slightly loosen the motor mounting bracket screws (**C**) and use a flat screwdriver to rotate the eccentric screw (**B**). When the desired tension is achieved, tighten the motor mounting bracket screws and check the tension again. Put the cover back.	
4.	If a replacement of the belt and/or the pulley is needed, remove the end flange to clear access to the locking device (**A**). Remove the locking screws and screw them in the adjacent holes to pull the device out. Release the centering ring (**B**). Remove the motor mounting bracket screws to loosen the belt and extract the belt and pulleys (**C**). To re-assemble, proceed in opposite order. The belt must be perfectly aligned on the two pulleys. The locking device screws must be tightened in a gradual uniform way, increasing the torque on each equally to 5Nm.	

Adjustment or replacement of the belt, vertical axis

Steps	Actions	Info/Illustration
1.	The IRPLP 050 must be in maintenance position (vertical carriage in low position).	
2.	If the vertical axis is mounted on an horizontal axis, remove the connectors side cover to disconnect the cables plug (**A**) and the pneumatic pipe (**B**). Remove the four M8 screws and two dowel pins Ø 8mm from the base of the vertical axis and take it off the horizontal axis. Lay the axis horizontally on the worktable.	
3.	Measure the tension of the belt (**A**), preferably with a tension gauge. If the tension is out of range, slightly loosen the motor mounting bracket screws (**C**) and use a flat screwdriver to adjust the gap between the motor bracket and the (**B**) axis half body. When the desired tension is achieved, tighten the motor mounting bracket screws and check the tension again.	
4.	If a replacement of the belt and/or the pulley is needed, remove the locking device screws and screw them in the adjacent holes to pull the device out. Release the centering ring (**B**). Remove the motor mounting bracket screws to loosen the belt and extract the belt and pulleys (**C**). To re-assemble, proceed in opposite order. The belt must be perfectly aligned on the two pulleys. The locking device screws must be tightened in a gradual uniform way, increasing the torque on each equally to 5Nm.	

6.6. SMB Battery pack replacement

General

NOTE: The SMB box contains a main board and a battery for the memory backup in order to maintain position data.

SMB boxes manufactured before 2015 are equipped with a SMB board DSQC633 Ref. 3HAC031851-001 and a SMB battery Ref. 3HAC16831-1.

SMB boxes manufactured after 2015 are equipped with a SMB board RMU101 Ref. 3HAC044168-001 and a Battery pack RMU Ref. 3HAC044075-001.

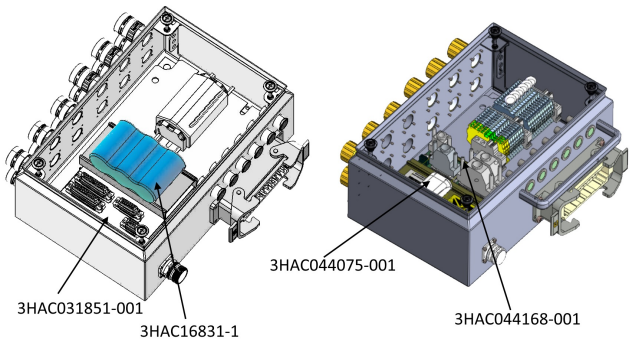
The battery should be replaced:

- Every three years.
- When the battery is going flat. This is generally shown by an error code on the FlexPendant screen (38213). Information about error codes can be found in the FlexPendant documentation.

In a new system the batteries are charged to full capacity after a few hours in STANDBY mode.

Instructions

	Action
1.	Position all of the carriages at the calibration point. See *Calibration points on page 64*.
2.	Switch off the power on the SMB box. **WARNING!** Turn off all electric power and pneumatic pressure supplies to the unit!
3.	Open the SMB box and locate the battery.
4.	Cut the plastic straps.
5.	Unplug the 2 wires cable from the board and remove the battery pack.
6.	Place the new battery pack, plug the connector on the board, and secure the pack with straps.
7.	Close the SMB box, switch on the power.
8.	Update the revolution counters of each axis.



SMB box content

6.7. Repair information

Replacement of critical parts

Some critical components require to be replaced by appropriately trained ABB personnel.

In the case of failure of the parts listed below, please contact ABB in order to arrange an on-site repair by an ABB technician, or send the unit (or axis) for “exchange repair”:

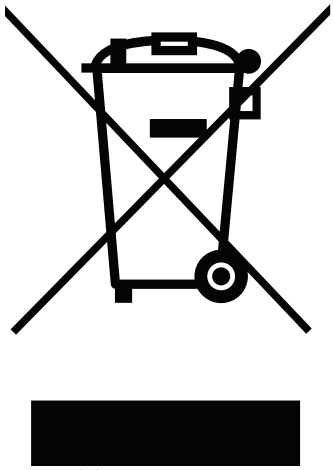
- The ballscrews
- The motors
- The internal cable chains

7 Decommissioning

7.1. Environmental information

Symbol

The following symbol indicates that the product must not be disposed of as common garbage. Handle each product according to local regulations for the respective content (see table below).



WEEE symbol

7.2. Decommissioning

Safety information

Before any service work is commenced, it is extremely important that all safety information is observed! Read *Safety on page 11* before performing any service work.

Precautions

The precautions below should be observed before proceeding with the decommissioning of the FlexPLP:

- All power supplies to the FlexPLP as well as to other machines within the danger zone must be turned off.
- Make sure that the pneumatic circuit is not pressurized.
- If required, the main switch should be locked.

Required equipment

Equipment	Note
Handling equipment	Specified in *Handling/lifting on page 43*.
Standard toolkit	Specified in *Standard toolkit on page 86*.

Hazardous material

The table specifies some of the materials in the track motion and their respective use throughout the product. Dispose of the components properly to prevent health or environmental hazards.

Material	Example application
Aluminium	Bodies, mobile carriage, etc.
Copper alloy	Cable, motor, etc.
Steel	Gears, screws, nuts, etc.
Plastic / Rubber (PVC)	Cables, connectors, belt, etc.

Oil and grease

Where possible, arrange for the oil and grease to be recycled. Dispose of oil and grease via an authorized person/contractor in accordance with local regulations. Do not dispose of oil and grease near lakes, ponds, ditches, down drains or onto soil. Incineration must be carried out under controlled conditions in accordance with local regulations.

Also note that:

- Spills may form a film on water surfaces causing damage to organisms. Oxygen transfer could also be impaired.
- Spillage may penetrate the soil causing ground water contamination.

8 Reference information

8.1. Introduction

General

This chapter includes general information, complementing the more specific information in the different procedures in the manual.

8.2. Unit conversion

Converter table

Use the following table to convert units used in this manual.

Quantity	Unit		
Length	1 m	3.28 ft	39.37 in
Weight	1 kg	2.21 lb	
Pressure	1 bar	100 kPa	14.5 psi
Force	1 N	0.738 lbf	
Moment	1 N.m	0.738 lbf-tn	
Volume	1 L	0.264 US gal	

8.3. Bolt, screws, tightening torques

Bolt and screws

Before tightening any screw, observe the following:

- Determine whether a **standard** tightening torque or **special** torque is to be applied. The **standard torques** are specified in the following tables. Any **special torques** are specified in the repair, maintenance or installation procedure descriptions. **Any special torque specified overrides the standard torque!**
- Use the *correct tightening torque* for each type of screw joint.
- Only use *correctly calibrated* torque keys.
- Always *tighten the joint by hand*, and never use pneumatic tools.
- Use the *correct tightening technique*, tighten the screw in a slow, flowing motion.
- Maximum allowed total deviation from the specified value is **10%**!

Unless indicated otherwise, the bolts used on (or provided with) the FlexPLP are of class 8.8.

Unless indicated otherwise, all bolts must be clean of oil or grease and tightened with a mild thread-locker such as Loctite 243.

Standard tightening torques

The following table specifies the recommended standard tightening torques for *hex screws* and *socket head hex screws*:

Screw thread size	M5	M6	M8	M10	M12
Tightening torque CLASS 8.8	5.5 N.m	9.5 N.m	23 N.m	46 N.m	79 N.m
Tightening torque CLASS 10.9	8.1 N.m	14 N.m	34 N.m	67 N.m	116 N.m
Tightening torque CLASS 12.9	9.5 N.m	16.4 N.m	40 N.m	79 N.m	136 N.m

The following table specifies the recommended standard tightening torque for *water and air connectors* when one or both connectors are made of brass:

Dimension	Tightening torque Nm - Nominal	Tightening torque Nm - Minimal	Tightening torque Nm - Maximum
1/8	12 N.m	8 N.m	15 N.m
1/4	15 N.m	10 N.m	20 N.m
3/8	20 N.m	15 N.m	25 N.m
1/2	40 N.m	30 N.m	50 N.m
3/4	70 N.m	55 N.m	90 N.m

8.4. Standard toolkit

General

All service (repairs, maintenance and installation) procedures contain lists of tools required to perform the specified activity.

All special tools required are listed directly in the procedures while all the tools that are considered standard are gathered in the standard toolkit and defined in the table below.

This way, the tools required are the sum of the standard toolkit and any tools listed in the instruction.

Contents, standard toolkit

Qty	Tool
1	Set of spanners
1	Hex keys (*Allen* key) 3, 4, 5, and 6 mm
1	Torque wrench 5-25 Nm
1	Ratchet head for torque wrench 1/4”
1	Socket head cap 4mm, 5mm and 6mm socket 1/4” bit L 20 MM (for socket head cap screws - ISO 4762)
1	Plastic mallet
1	Dowel Pin remover
1	Mild thread-locker (Recommended: Loctite 243)

8.5. Special tools

General

All service instructions contain lists of tools required to perform the specified activity. The required tools are a sum of standard tools, defined in the section *Standard toolkit on page 86*, and of special tools, listed directly in the instructions and also gathered in this section.

Special tools

The following table specifies the special tools required during several of the service procedures. The tools are also specified directly in concerned instructions in the Product manual.

For operations on pneumatic connectors:		
Qty	**Tool**	**Product**
1	Thread sealant for conical fittings	Loctite 577
For operations on electrical parts:		
Qty	**Tool**	**Product**
1	Wire strippers	
1	Cable cutters	

Special tools available from ABB

The following table specifies the special tools required during several of the service procedures. The tools may be ordered separately and are also specified directly in concerned instructions in the Product manual.

Qty	Tool	ABB Article no.
1	Fine calibration shim	3HAW050008818
1	Tension gauge	3HAW050009048

8.5. Special tools

9 Spare parts

9.1. Introduction

General

This chapter specifies all spare parts and replacement articles of the FlexPLP. It is divided in 5 sections:

- Spare parts for horizontal axes (usually axis X and Y), which share most of their components.
- Spare parts for vertical axis (usually axis Z)
- Spare parts for covers
- Electrical parts: SMB boxes, static cables, and internal cables
- Pneumatic parts.

Some spare parts must be chosen according to the strokes of your PLP: The horizontal axes exist in versions for 300mm and 400mm stroke.

The type of ballscrew for the first and second axis also depends on the type of PLP: Typically, they are equipped with ballscrews type16x5. However, if the unit is mounted in a position such as the first and/or second axis is not horizontal, a ballscrew type 16x2 may be used.

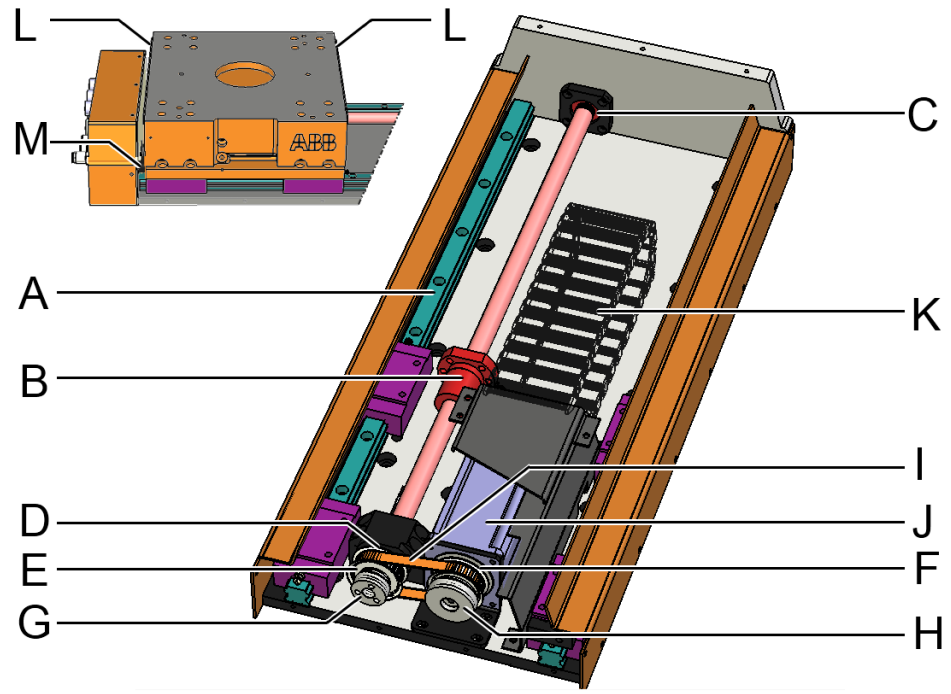
Depending on the date of manufacturing, the internal cables and motors may be of different types:

- Cables: *ILME* type (used before 2013), or *Harting* type (used from 2013)
- Motor: 3HAWC116580 (used before 2013) 3HAWL000201 (used from 2013)

In any case, contact ABB if you do not know what type of material is required for your PLP.

9.2. Spare parts horizontal axis

Horizontal axis



Axis 1-2

Item	Quantity	ABB part reference no.	Note
A	2	3HAW050008801	Guideway stroke 400mm + 2 ball bearing blocks
		3HAW050008802	Guideway stroke 300mm + 2 ball bearing blocks
B	1	3HAW050031125 (Replaces 3HAW050008821)	Ballscrew stroke 400mm type 16x5
		3HAW050008804	Ballscrew stroke 400mm type 16x2 (option)
		3HAW050031225 (Replaces 3HAW050008822)	Ballscrew stroke 300mm type 16x5
		3HAW050008817	Ballscrew stroke 300mm type 16x2 (option)
C	1	3HAWC116570	Guide bearing FF
D	1	3HAWC116569	Guide bearing BK
E	1	3HAW050008806	Pulley, ballscrew shaft
F	1	3HAW050008816	Pulley, motor shaft
G	1	3HAWC116574	Locking device, ballscrew shaft
H	1	3HAWC116575	Locking device, motor shaft
I	1	3HAWC116576	Belt axis 1-2 (For the tension adjustment, Order in addition the tension gauge 3HAW050009048. See *Special tools on page 87*.)

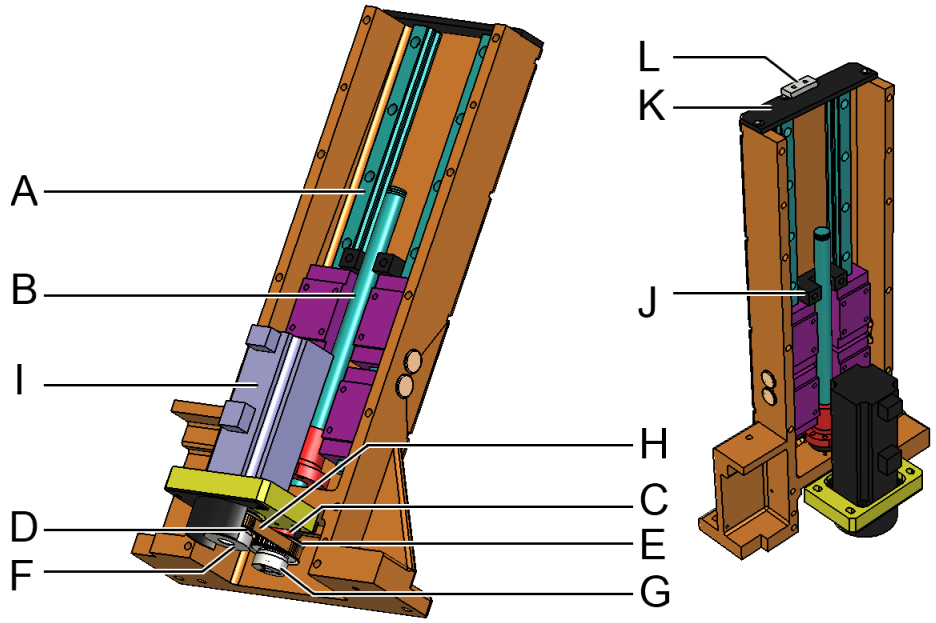
Item	Quantity	ABB part reference no.	Note
J	1	3HAWL000201	Motor, type used from 2013 on
		3HAWC116580	Motor, type used before 2013
K	1	3HAWL000225	Internal cable chain, Axis 1 or 2, stroke 400mm
		3HAWL000226	Internal cable chain, Axis 1 or 2, stroke 300mm
L	2	3HAW050031118	Oil scrapper
M	1	3HAW050031132	Hard stop

Contact ABB if you do not know whether your FlexPLP requires:

- Material for 300mm or 400mm stroke
- Ballscrew type 16x5 or 16x2
- Motor 3HAWC116580 (used before 2013) or 3HAWL000201 (used from 2013)

9.3. Spare parts vertical axis

Vertical axis



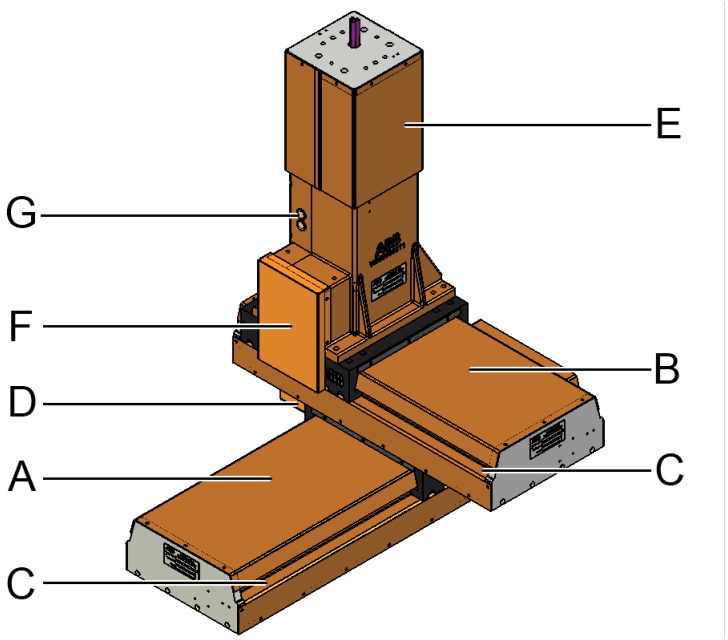
Axis 3

Item	Quantity	ABB part reference no.	Note
A	2	3HAW050008803	Guideway stroke 200mm + 2 ball bearing blocks
B	1	3HAW050031325 (Replaces 3HAW050008805)	Ballscrew stroke 200mm
C	1	3HAWC116571	Guide bearing FK
D	1	3HAW050008806	Pulley, ballscrew shaft
E	1	3HAW050008816	Pulley, motor shaft
F	1	3HAWC116574	Locking device, ballscrew shaft
G	1	3HAWC116575	Locking device, motor shaft
H	1	3HAWC116577	Belt axis 3 (For the tension adjustment, Order in addition the tension gauge 3HAW050009048. See *Special tools on page 87*.)
I	1	3HAWL000201	Motor, type used from 2013 on
		3HAWC116580	Motor, type used before 2013
J	1	3HAW050008812	Axis 3 upper position hard stop
K	1	3HAW050031317	Axis 3 hard stop plate
L	1	3HAW050031322	Axis 3 lower position hard stop

Contact ABB if you do not know whether your FlexPLP requires motors 3HAWC116580 (used before 2013) or 3HAWL000201 (used from 2013)

9.4. Covers

Covers



Covers

Item	Quantity	ABB part reference no.	Note
A	1	3HAW050031133	Upper cover, axis 1, stroke 400mm
		3HAW050031233	Upper cover, axis 1, stroke 300mm
B	1	3HAW050031117	Upper cover, axis 2, stroke 400mm
		3HAW050031217	Upper cover, axis 2, stroke 300mm
C	2 per axis	3HAW050031116	Side cover, stroke 400mm
		3HAW050031216	Side cover, stroke 300mm
D	1	3HAW050031218	Axis 2 connectors cover
E	1	3HAW050031320	Axis 3 cover
F	1	3HAW050031323	Axis 3 connectors cover
G	5	3HAWL000227	Closing plug

9.5. Cables

Cables: from controller to SMB box

ABB part reference no.	Description
3HAW050008612-005	6 axis resolver static cable XS41-2 5m
3HAW050008612-010	6 axis resolver static cable XS41-2 5m
3HAW050008612-015	6 axis resolver static cable XS41-2 10m
3HAW050008614-005	3 axis motor static cable XP7 400-600V 5m
3HAW050008614-010	3 axis motor static cable XP7 400-600V 10m
3HAW050008614-015	3 axis motor static cable XP7 400-600V 15m
3HAW050008616-005	6 axis motor static cable XP1 400V (low voltage) 5m
3HAW050008615-005	6 axis motor static cable XP1 400V (high voltage) 5m
3HAW050008616-010	6 axis motor static cable XP1 400V (low voltage) 10m
3HAW050008615-010	6 axis motor static cable XP1 400V (high voltage) 10m
3HAW050008616-015	6 axis motor static cable XP1 400V (low voltage) 15m
3HAW050008615-015	6 axis motor static cable XP1 400V (high voltage) 15m

SMB boxes

ABB part reference no.	Description
3HAW050008604	SMB box 1 axis M2008
3HAW050008605	SMB box 3 axis M2008
3HAW050008651	SMB box 6 axis M2011
3HAC031851-001	SMB Main board DSQC633. Phased out! Order instead the set 3HAC046686-001 (board RMU101 + battery pack RMU)
3HAC16831-1	Battery pack for SMB board DSQC633. For SMB boxes manufactured before 2015 only.
3HAC044168-001	SMB Main board RMU101
3HAC044075-001	Battery pack for SMB board RMU101
3HAW050008607	PTC shunt M2008

Cables: from SMB box to mechanical unit

Quantity	ABB part reference no.	Description
1 per axis	3HAW050008625-005	1 Resolver Static M2008 5m
1 per axis	3HAW050008625-010	1 Resolver Static M2008 10m
1 per axis	3HAW050008625-015	1 Resolver Static M2008 15m
1 per axis	3HAW050008624-005	1 Motor Static or Extension M2008 5m
1 per axis	3HAW050008624-010	1 Motor Static or Extension M2008 10m
1 per axis	3HAW050008624-015	1 Motor Static or Extension M2008 15m

Internal cables

Depending on the date of manufacturing, the internal cables may be of different types: *ILME* type (used before 2013), or *Harting* type (used from 2013).

If you don't know what type of internal cables should be ordered for your PLP, please contact ABB.

Below are the ABB references for the internal cables, *ILME* type, used before 2013:

Axis	ABB part reference no.	Description
1	3HAWL000219	Internal cable axis 1, stroke 400mm (*ILME* type)
2	3HAWL000224	Internal cable axis 2, stroke 400mm (*ILME* type)
	3HAWL000220	Internal cable axis 2, stroke 300mm (*ILME* type)
3	3HAWL000221	Internal cable axis 3 (*ILME* type)

Below are the ABB references for the internal cables, *HARTING* type used from 2013 on:

Axis	ABB part reference no.	Description
1	3HAWL000901	Internal cable axis 1, stroke 400mm (*Harting* type version 2013)
	3HAWL000902	Internal cable axis 1, stroke 300mm (*Harting* type version 2013)
2	3HAWL000903	Internal cable axis 2, stroke 400mm (*Harting* type version 2013)
	3HAWL000904	Internal cable axis 2, stroke 300mm (*Harting* type version 2013)
3	3HAWL000905	Internal cable axis 3 (*Harting* type version 2013)

9.6. Pneumatic parts

Pneumatic parts

Axis - Quantity	ABB part reference no.	Description	Picture
through axis 1, 2, 3 4 meters	3HAWL000228	Pneumatic pipe (4 meters)	-
axis 1 - 1pc	3HAWC108650	Bulkhead connector D8 -D8	 bulkhead D8
axis 1 - 1pc axis 2 - 1pc	3HAWC101125	Internal hex head plug (brass) R1/8	 plug R/18
axis 1 - 1pc axis 2 - 1pc	3HAWC106282	Male stud elbow D8 - G1/8	 stud elbow D8 G1/8
axis 1 - 1pc axis 2 - 1pc	3HAWC116995	Male elbow 45° D8 - G1/8	 elbow 45 D8 G1/8
axis 2 - 1pc	3HAWC102353	Equal elbow D8 - D8	 elbow 90 D8 D8

10 Appendix

10.1. Electrical diagrams

List

This chapter contains the following wiring diagrams:

- 3HAWL000700: PLP internal cable wiring
- 3HAW050008605: SMB box 3 axis M2008
- 3HAW050008651: SMB box 6 axis M2011
- 3HAW050008607: PTC shunt M2008
- 3HAW050008612: 6 axis resolver static cable XS41-2
- 3HAW050008616: 6 axis motor static cable XP1 400V
- 3HAW050059517: 3 axis motor static cable XP1 400V

10 Appendix

10.1. Electrical diagrams

Project Discription	PLP Internal Cable Wiring (ABB RS BIW Internal Use)
Document Number	3HAWL000700
Revision	001

Number of pages 5

Respsonsible Department: RS/BIW		PLP Internal Cable Wiring (ABB RS BIW Internal Use)		Title page / cover sheet	Status: Approved
Prepare by, Date N,Cao 2012-11-19	Approve by,Date A,Stapelberg	Replacement of	Replaced by		Document no. 3HAWL000700 Rev.Ind 001 Page 0 Total Page 5

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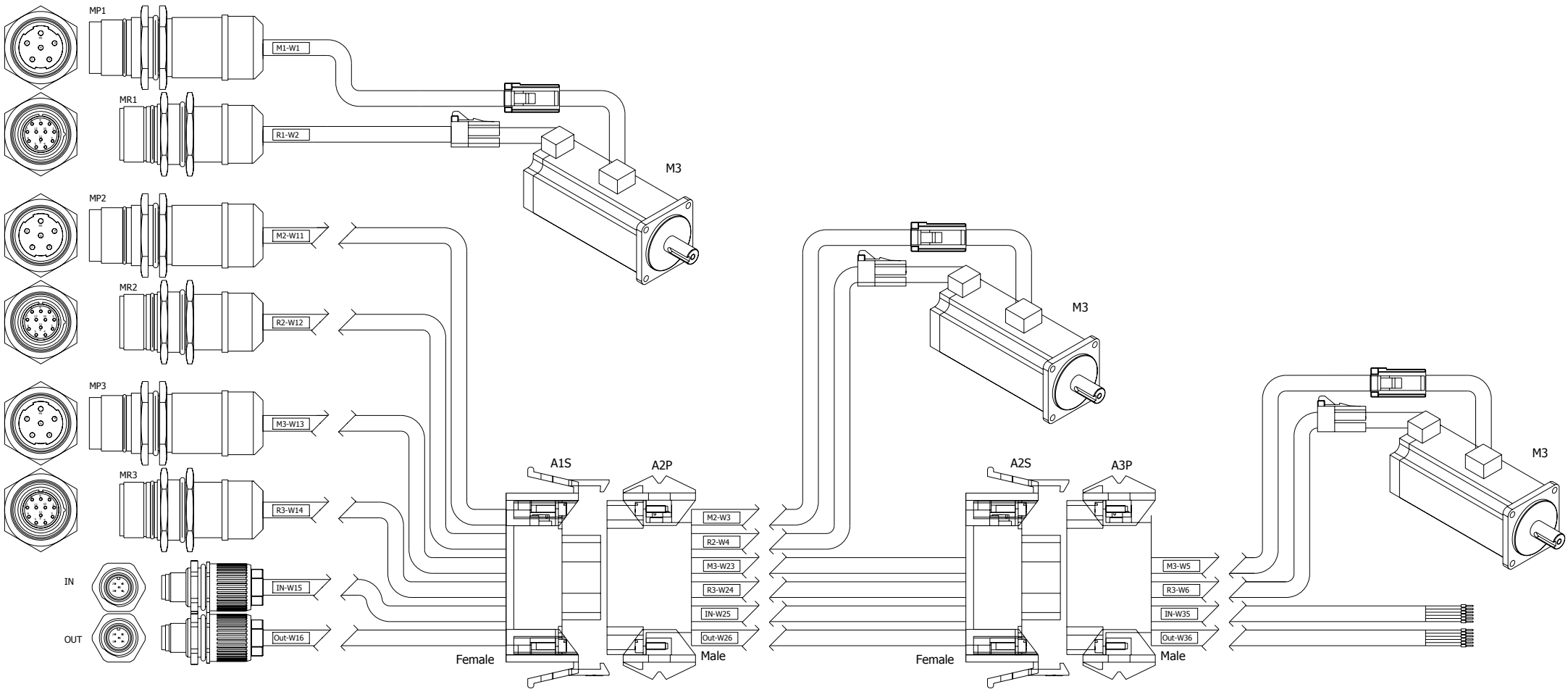
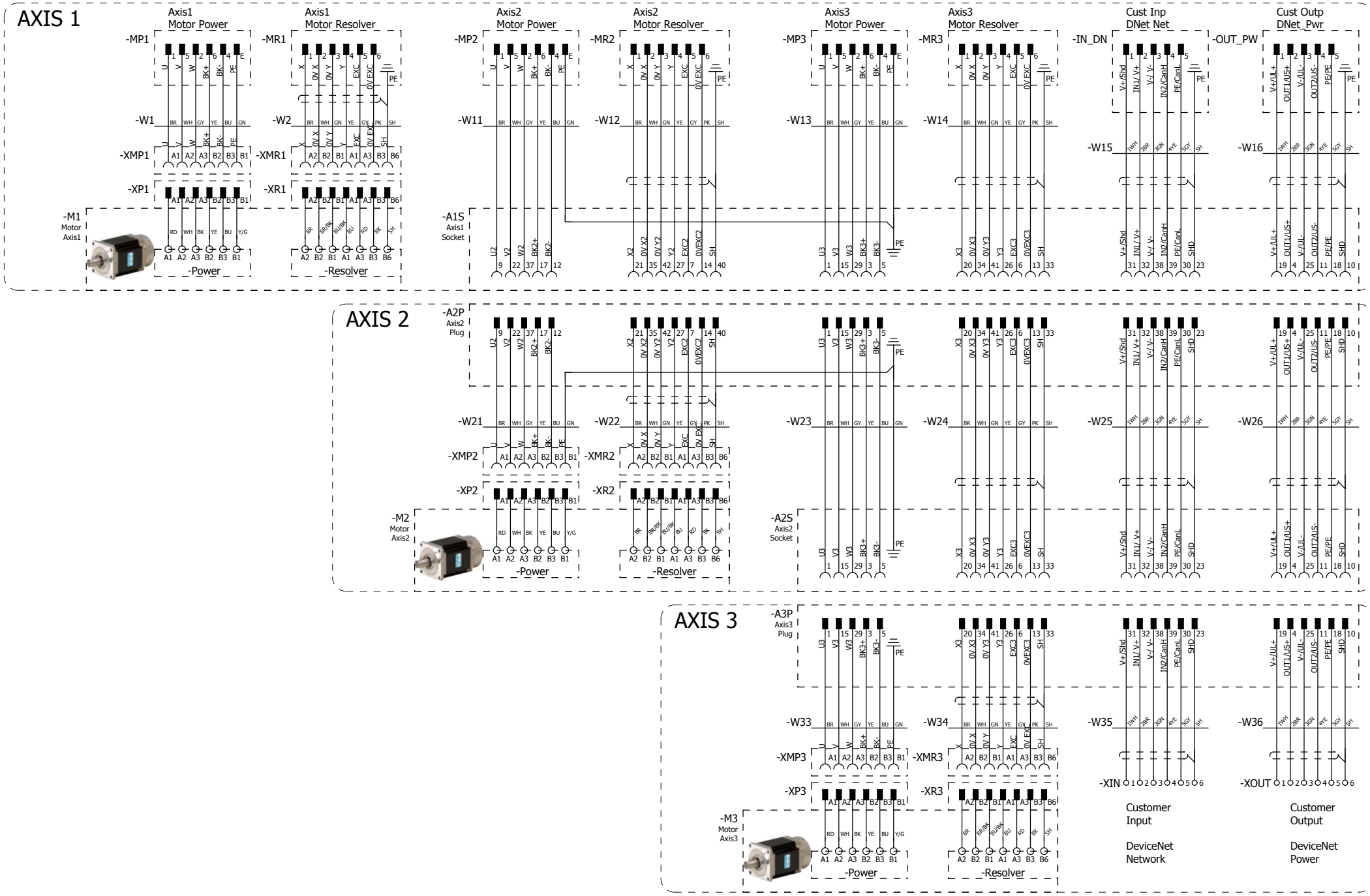


Respsonsible Department: RS/BIW		PLP Internal Cable Wiring (ABB RS BIW Internal Use)		Layout	Status: Approved
Prepare by, Date N,Cao 2012-11-19	Approve by,Date A,Stapelberg	Replacement of	Replaced by		Document no. 3HAWL000700

Rev.Ind 001 | Page 2 | Total Page 5



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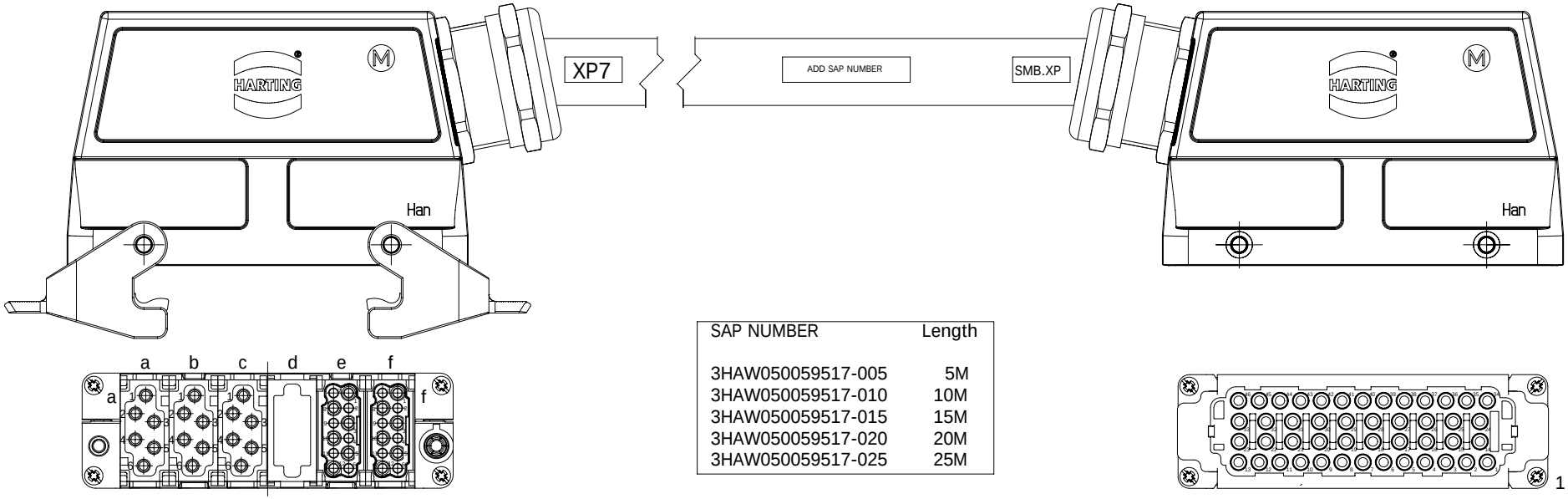
Prepare by, Date N,Cao 2012-11-19	Approve by,Date A,Stapelberg	Replacement of	Replaced by		Document no. 3HAWL000700

Rev.Ind 001 | Page 3 | Total Page 5

Project Discription	3Motor Power StaticCable IRC5.XP7 to SMB.XP For PLP50
Document Number	3HAW050059517-XXX
Revision	001

Number of pages 8

Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes
Technical Provisions	TP	3HAB8053-1	Manufact Moving Cable



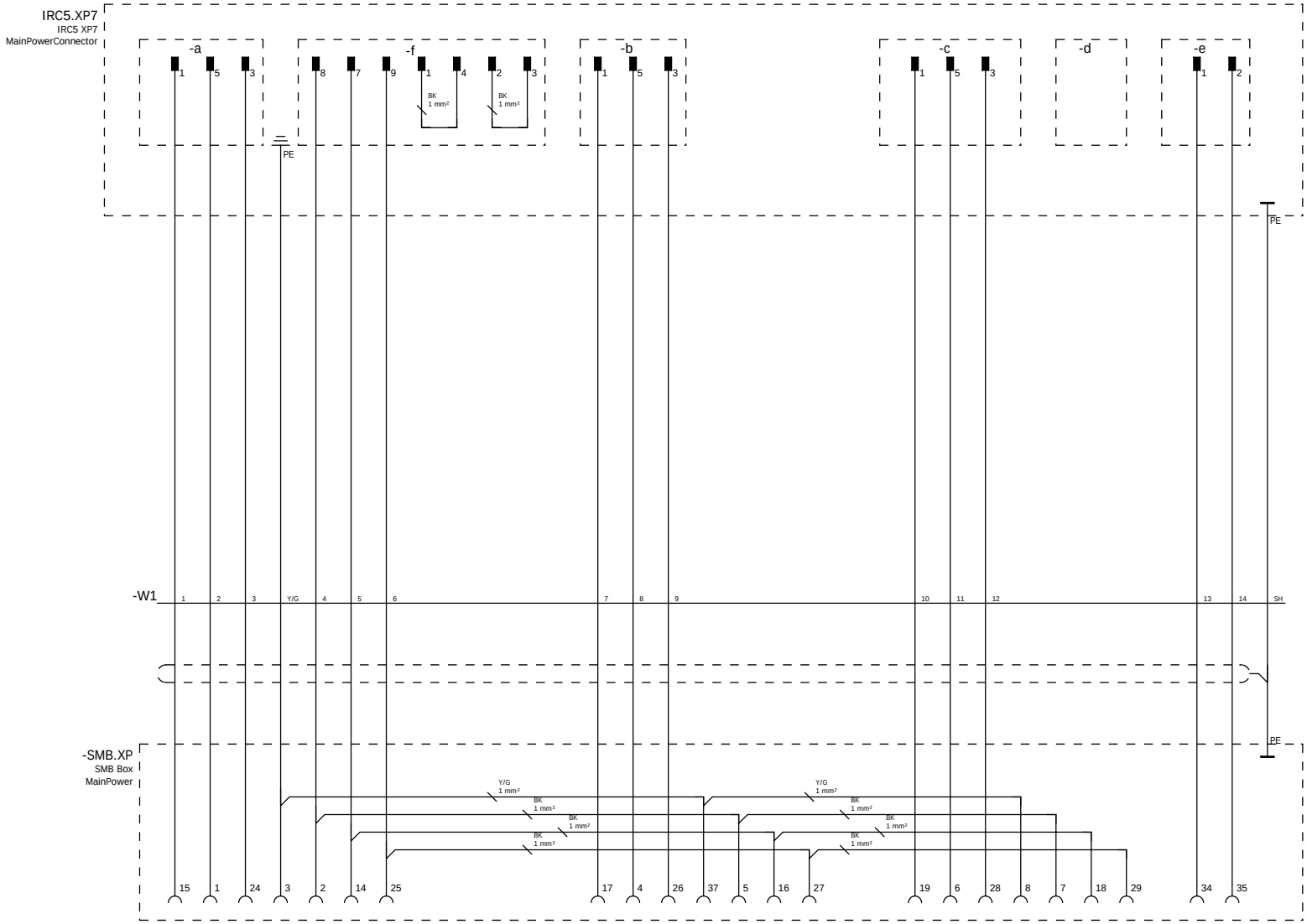
SAP NUMBER	Length
3HAW050059517-005	5M
3HAW050059517-010	10M
3HAW050059517-015	15M
3HAW050059517-020	20M
3HAW050059517-025	25M

1

1 3

Respsonsible Department: RS / BIW	3Motor Power StaticCable IRC5.XP7 to SMB.XP For PLP50		Layout	Status: Approved	= +
Prepare by, Date N,Cao 7/10/2015	Approve by,Date	Replacement of / Replaced by		Document no. 3HAW050059517-XXX	Rev.Ind 001
					Page 2 / Total Page 8

IRC5 Cabinet
XP/XS7



	3Motor Power StaticCable IRC5.XP7 to SMB.XP For PLP50		Connection	Status: Approved	=
Respsonsible Department: RS / BIW				Document no. 3HAW050059517-XXX	Rev.Ind 001
Prepare by, Date N,Cao 7/10/2015	Approve by,Date	Replacement of	Replaced by		Page 3 / Total Page 8

Cable diagram

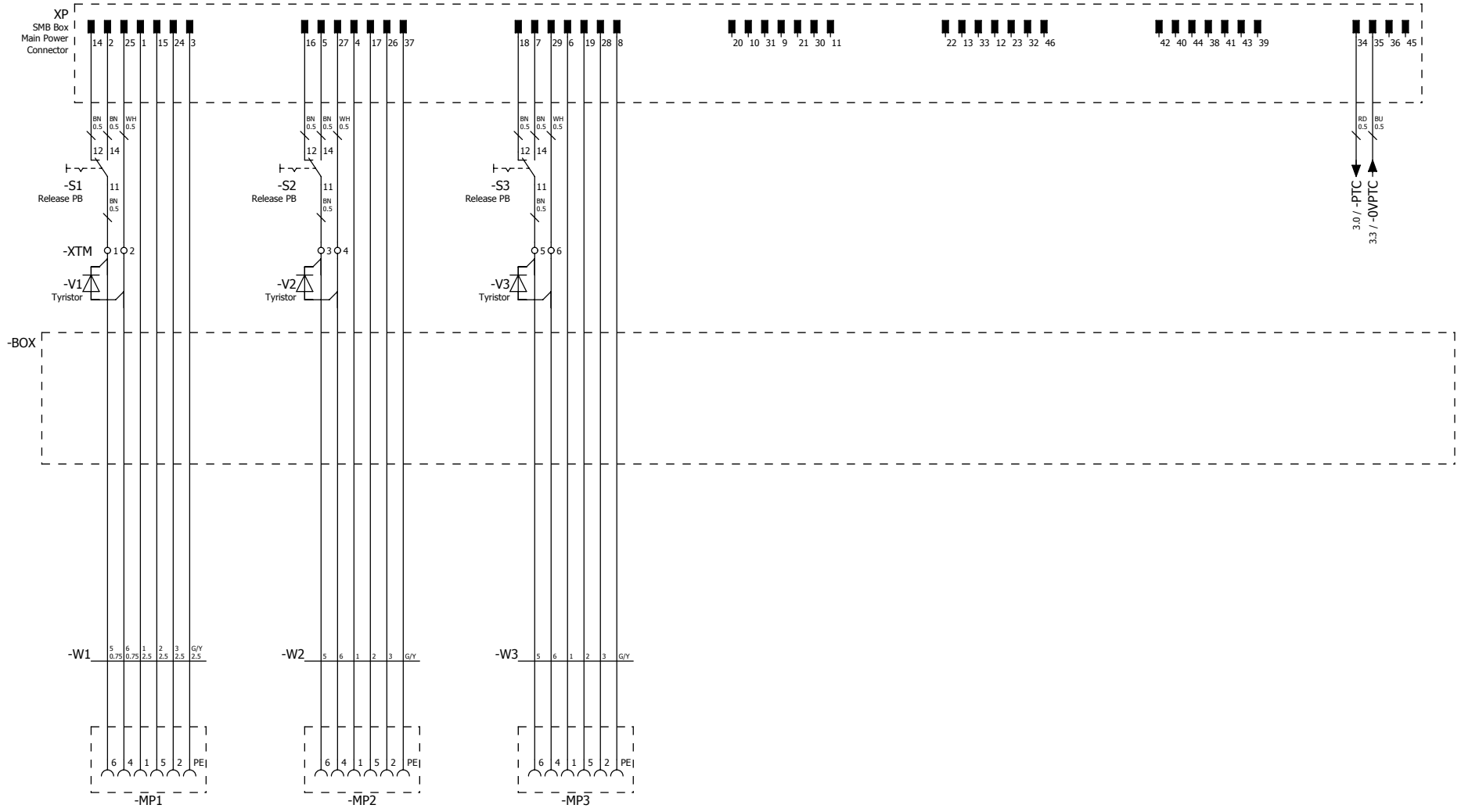
F09_002_ABB

Cable name	=+-W1		cable type	Helukabel.83758				
function text			no. of conductors	18G		cross-section 1.5mm		Length
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U7	/3.1	-IRC5.XP7-a	1	1	-SMB.XP	15	/3.1	V7
V7	/3.1	-IRC5.XP7-a	5	2	-SMB.XP	1	/3.1	U7
W7	/3.1	-IRC5.XP7-a	3	3	-SMB.XP	24	/3.1	W7
24V PB	/3.2	-IRC5.XP7-f	8	4	-SMB.XP	2	/3.2	24V PB7
24V Rel	/3.2	-IRC5.XP7-f	7	5	-SMB.XP	14	/3.2	24V REL7
0V BK	/3.2	-IRC5.XP7-f	9	6	-SMB.XP	25	/3.2	0V BK7
U8	/3.3	-IRC5.XP7-b	1	7	-SMB.XP	17	/3.3	V8
V8	/3.3	-IRC5.XP7-b	5	8	-SMB.XP	4	/3.3	U8
W8	/3.4	-IRC5.XP7-b	3	9	-SMB.XP	26	/3.4	W8
U9	/3.5	-IRC5.XP7-c	1	10	-SMB.XP	19	/3.5	V9
V9	/3.5	-IRC5.XP7-c	5	11	-SMB.XP	6	/3.5	U9
W9	/3.5	-IRC5.XP7-c	3	12	-SMB.XP	28	/3.5	W9
PTC	/3.6	-IRC5.XP7-e	1	13	-SMB.XP	34	/3.6	PTC
0V PTC	/3.7	-IRC5.XP7-e	2	14	-SMB.XP	35	/3.7	0V PTC
	/3.7	-IRC5.XP7	PE	SH	-SMB.XP	PE	/3.7	
	/3.1	-IRC5.XP7	PE	Y/G	-SMB.XP	3	/3.1	PE

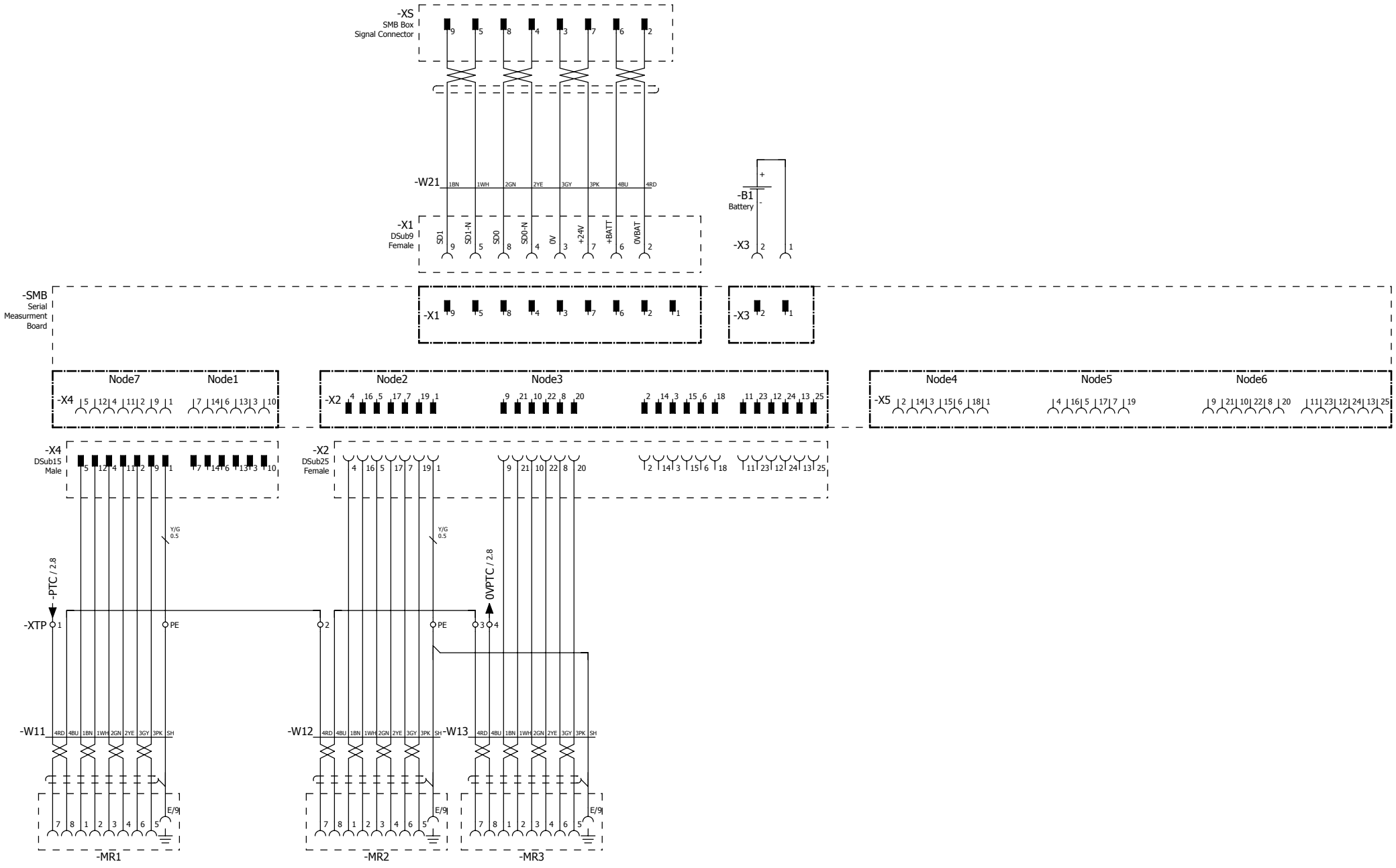
Respsonsible Department: RS / BIW	3Motor Power StaticCable IRC5.XP7 to SMB.XP For PLP50	ABB	Cable diagram =+-W1	Status: Approved	= +
Prepare by, Date N,Cao 7/10/2015	Approve by,Date	Replacement of	Replaced by	Document no. 3HAW050059517-XXX	Rev.Ind 001
					Page 4 / Total Page 8

Project Discription	SMB Box For 3 Axis M2008
Document Number	3HAW050008605
Revision	008

Number of pages 21

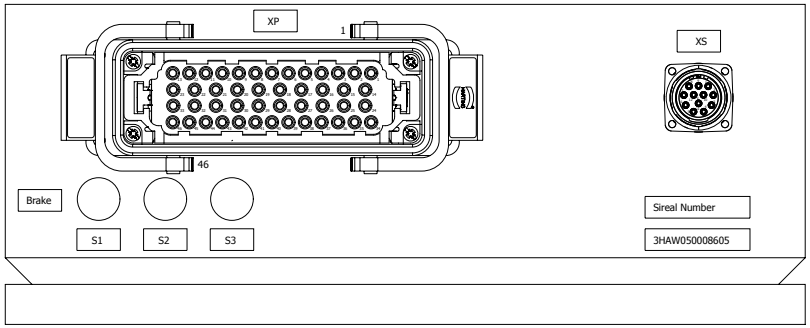


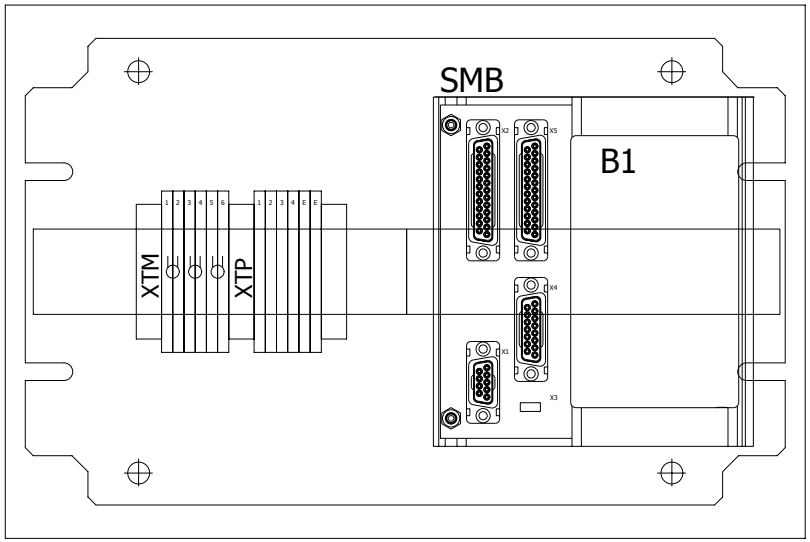
		SMB Box For 3 Axis M2008		Power	Status: Approved 2012-6-1	=	
Respsonsible Department: RS/BIW						+	
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-6-1	Replacement of	Replaced by		Document no. 3HAW050008605	Rev.Ind 008	Page 2 / Total Page 21

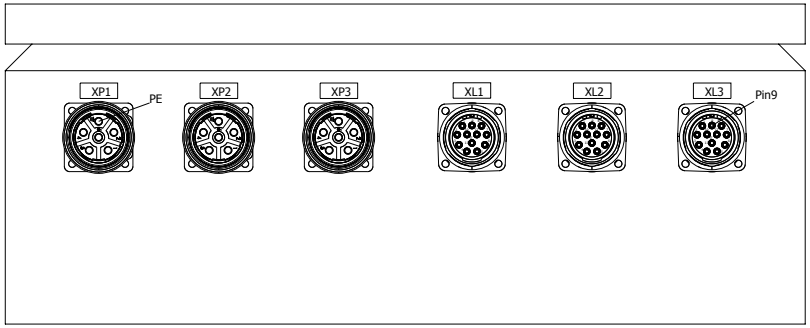


Respsonsible Department: RS/BIW		SMB Box For 3 Axis M2008	ABB	Signal	Status: Approved 2012-6-1
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-6-1	Replacement of	Replaced by		Document no. 3HAW050008605 Rev.Ind 008 Page 3 Total Page 21

Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes

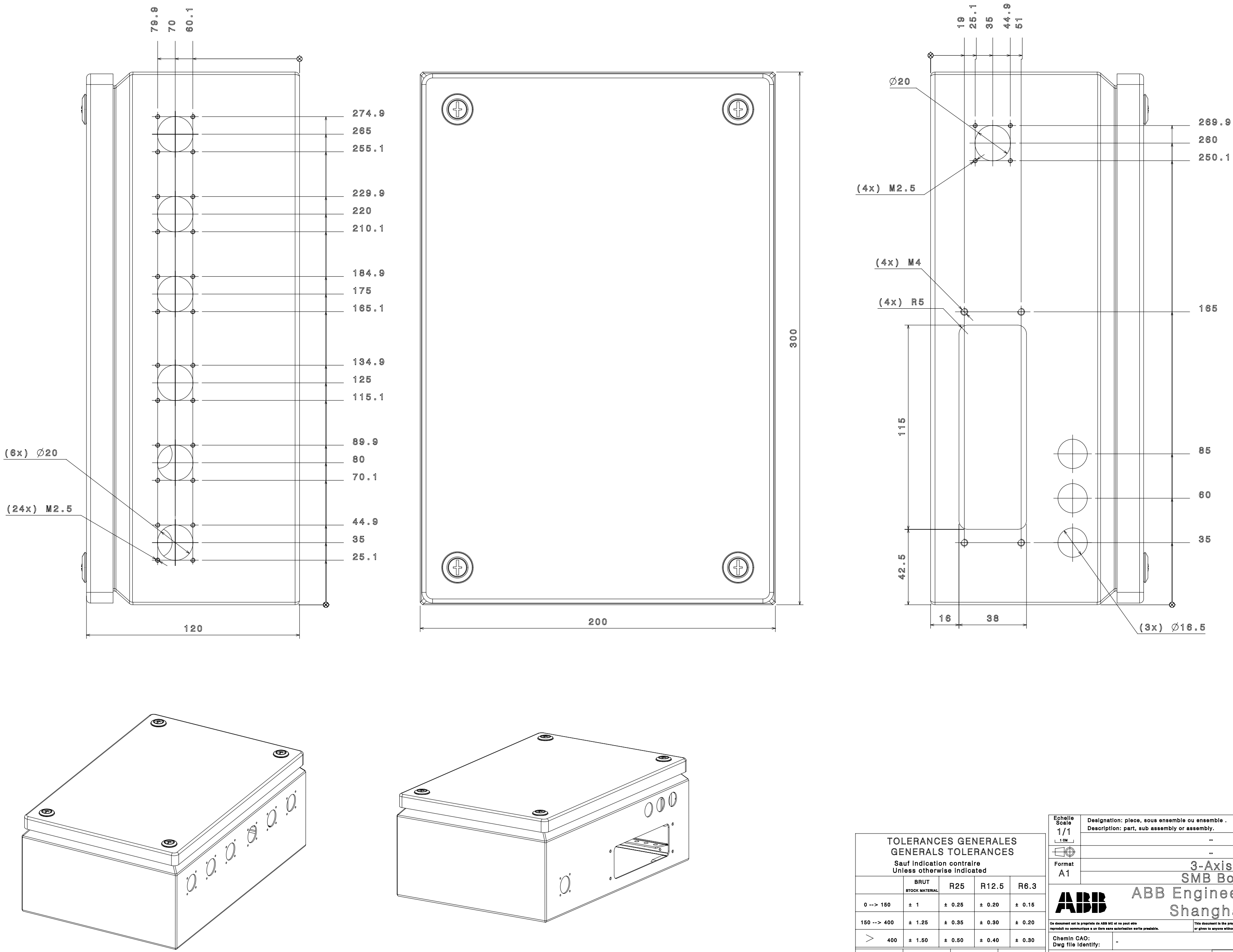






Respsonsible Department: RS/BIW		SMB Box For 3 Axis M2008		Layout	Status: Approved 2012-6-1
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-6-1	Replacement of	Replaced by		Document no. 3HAW050008605 Rev.Ind 008 Page 4 Total Page 21

Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes



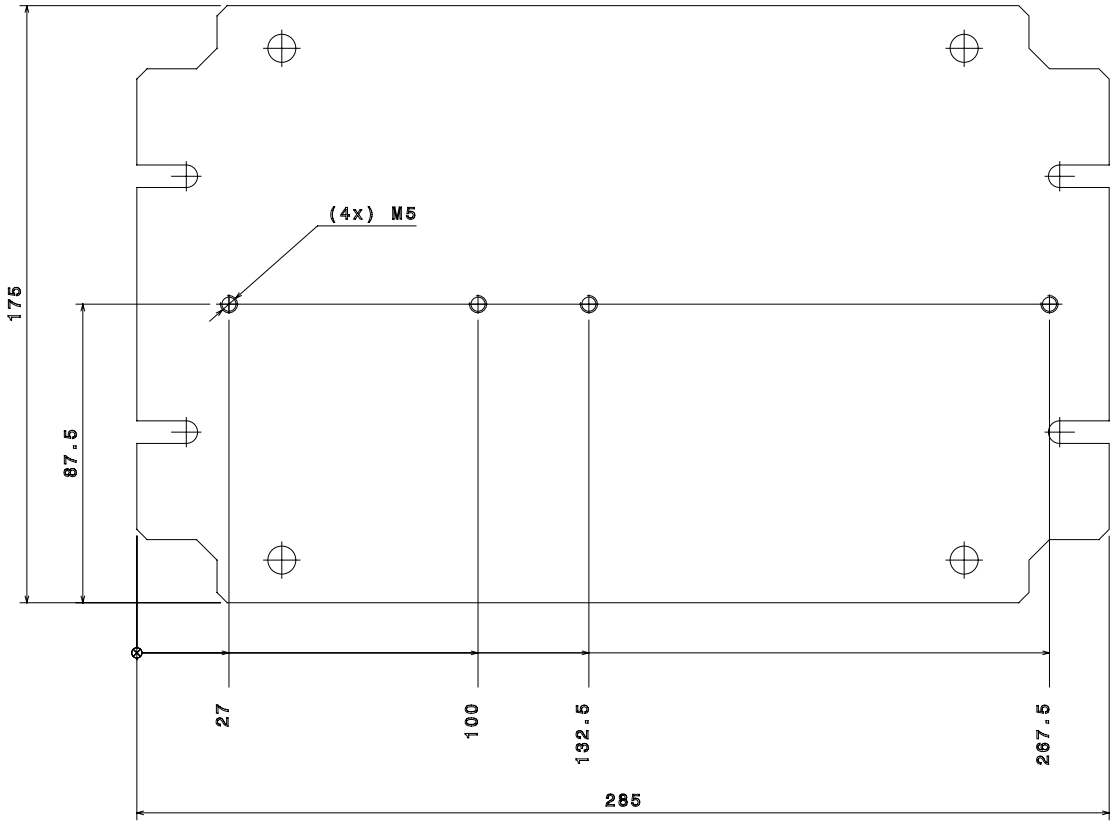
TOLERANCES GENERALES GENERALS TOLERANCES Sauf indication contraire Unless otherwise indicated	BRUT STOCK MATERIAL	R25	R12.5	R6.3
0 --> 150	± 1	± 0.25	± 0.20	± 0.15
150 --> 400	± 1.25	± 0.35	± 0.30	± 0.20
> 400	± 1.50	± 0.50	± 0.40	± 0.30
	⊥	//	▱	
USINE MACHINED	0.2/1000	0.2/1000	0.3/1000	
BRUT STOCK MATERIAL	2/1000	2/1000	2.5/1000	

Echelle / Scale: 1/1
Designation: piece, sous ensemble ou ensemble .
Description: part, sub assembly or assembly.
Matiere / Material: KL1503.510
Traitement / Treatment: -
Format: A1
3-Axis SMB Box
Brut / Stock: 300 X 200 X 120
ABB Engineer Ltd. Shanghai
ABB MC, No.5, Lane 369, Chuangye Road, Kangqiao Town, Shanghai, P.R.China
Systeme CAO / CAD system: CATIA V5
Chemin CAO: / Dwg file identify: -
Date: 28/03/2011
Dessine par: / Drawn by: Zhang Huiyun
Visa: / Approved: -
Planche / Sheet: 1/1
KL1503.510-SMB-Box-3

4 | 4.b

Respsonsible Department: RS/BIW		SMB Box For 3 Axis M2008	Box Drill Hole	Status: Approved 2012-6-1	
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-6-1	Replacement of / Replaced by		Document no. 3HAW050008605	Rev.Ind 008 / Page 4.a / Total Page 21

Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes



TOLERANCES GENERALES GENERALS TOLERANCES Sauf indication contraire Unless otherwise indicated	BRUT STOCK MATERIAL	R25	R12.5	R6.3
0 --> 150	± 1	± 0.25	± 0.20	± 0.15
150 --> 400	± 1.25	± 0.35	± 0.30	± 0.20
> 400	± 1.50	± 0.50	± 0.40	± 0.30

	⊥	//	▱
USINE MACHINED	0.2/1000	0.2/1000	0.3/1000
BRUT STOCK MATERIAL	2/1000	2/1000	2.5/1000

Echelle Scale	1/1	Designation: piece, sous ensemble ou ensemble . Description: part, sub assembly or assembly.
		--
		--
Format A2		Holes drilled after SMB Box

Matiere
Material: KL1563.700

Traitement
Treatment: -

Brut
Stock: -

ABB Engineer Ltd.
Shanghai

ABB MC
No.5,Lane 369,
Chuangye Road,
Kangqiao Town,
Shanghai,P.R.China
Tel:+86 21 81368879

Chemin CAO:
Dwg file identify: -

Systeme CAO:
CAD system: CATIA V5

Date: 28/03/2011

Dessine par:
Drawn by: Zhang Hulyun

Vise:
Approved: -

-

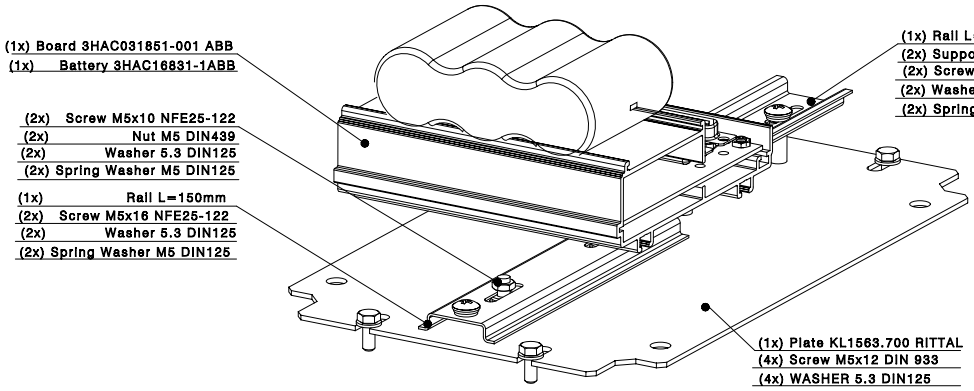
KL1563.700

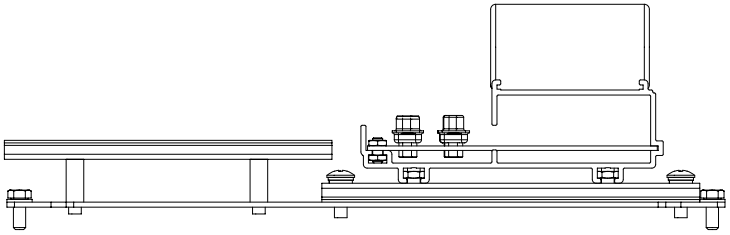
Planche
Sheet: 1/1

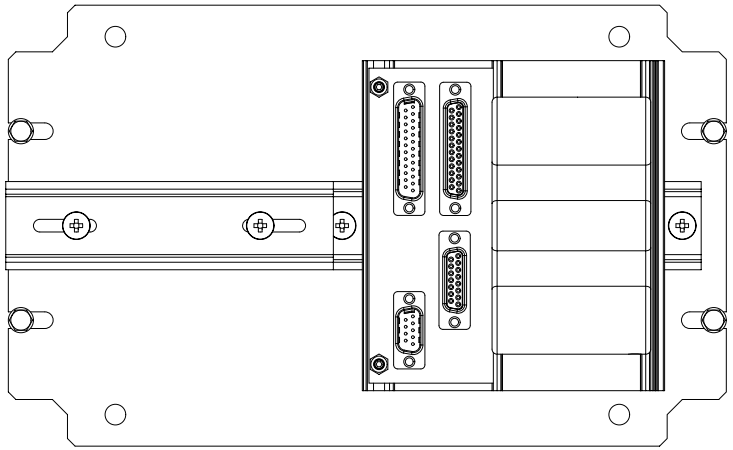
4.a 4.c

Respsonsible Department: RS/BIW		SMB Box For 3 Axis M2008		Plate Drill Hole	Status: Approved	2012-6-1	= +
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-6-1	Replacement of	Replaced by		Document no. 3HAW050008605	Rev.Ind 008	Page 4.b / Total Page 21

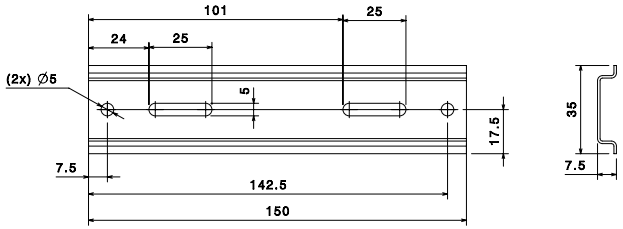
Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes



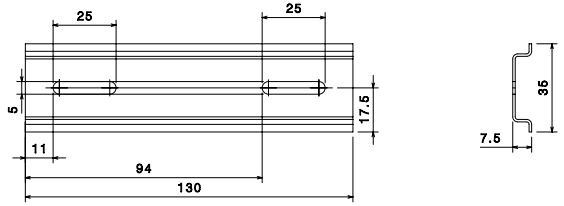




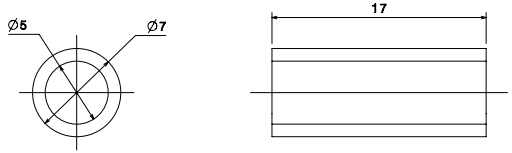
Rail L=150mm



Rail L=130mm



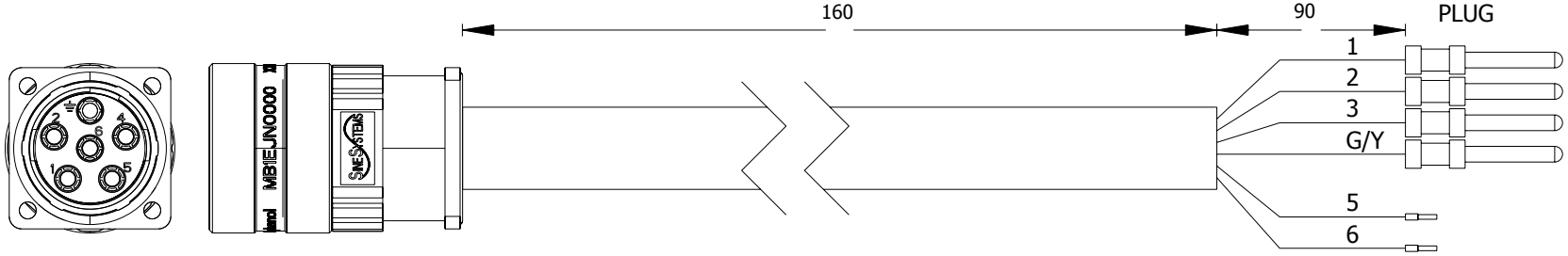
Support 7x5x17



Respsonsible Department: RS/BIW		SMB Box For 3 Axis M2008	ABB	Rail Installation On Plate	Status: Approved 2012-6-1
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-6-1	Replacement of	Replaced by		Document no. 3HAW050008605 Rev.Ind 008 Page 4.c Total Page 21

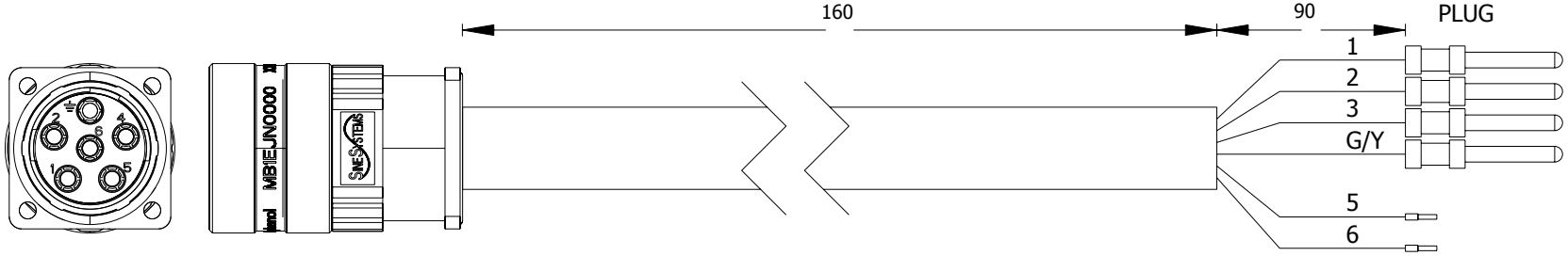
Cable diagram

Cable name =+-W1			cable type Lappkabel:0036026					
function text			no. of conductors 4G2.5+2x0.75mm			cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.1	-MP1	1	1	-XP	1	/2.1	
V	/2.1	-MP1	5	2	-XP	15	/2.1	
W	/2.1	-MP1	2	3	-XP	24	/2.1	
BK+	/2.1	-MP1	6	5	-XTM	1	/2.1	
BK-	/2.1	-MP1	4	6	-XTM	2	/2.1	
PE	/2.1	-MP1	PE	G/Y	-XP	3	/2.1	



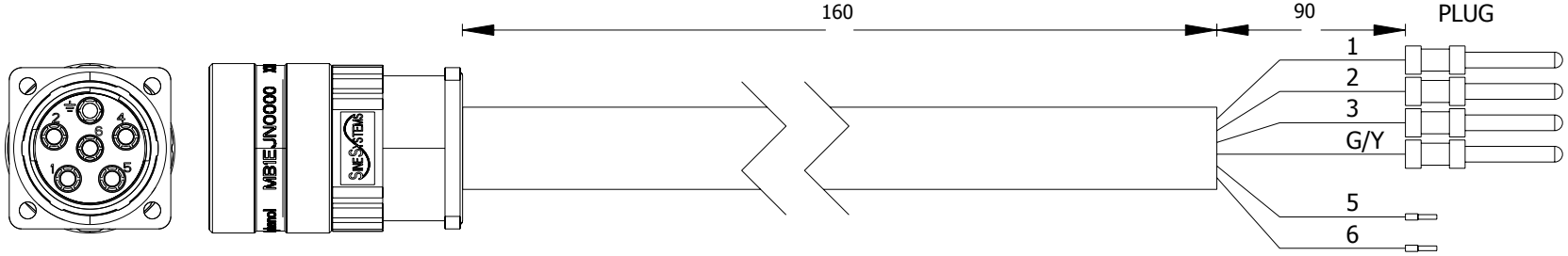
Cable diagram

Cable name =+-W2			cable type Lappkabel:0036026					
function text			no. of conductors 4G2.5+2x0.75mm			cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.2	-MP2	1	1	-XP	4	/2.2	
V	/2.2	-MP2	5	2	-XP	17	/2.2	
W	/2.2	-MP2	2	3	-XP	26	/2.2	
BK+	/2.2	-MP2	6	5	-XTM	3	/2.2	
BK-	/2.2	-MP2	4	6	-XTM	4	/2.2	
PE	/2.3	-MP2	PE	G/Y	-XP	37	/2.3	



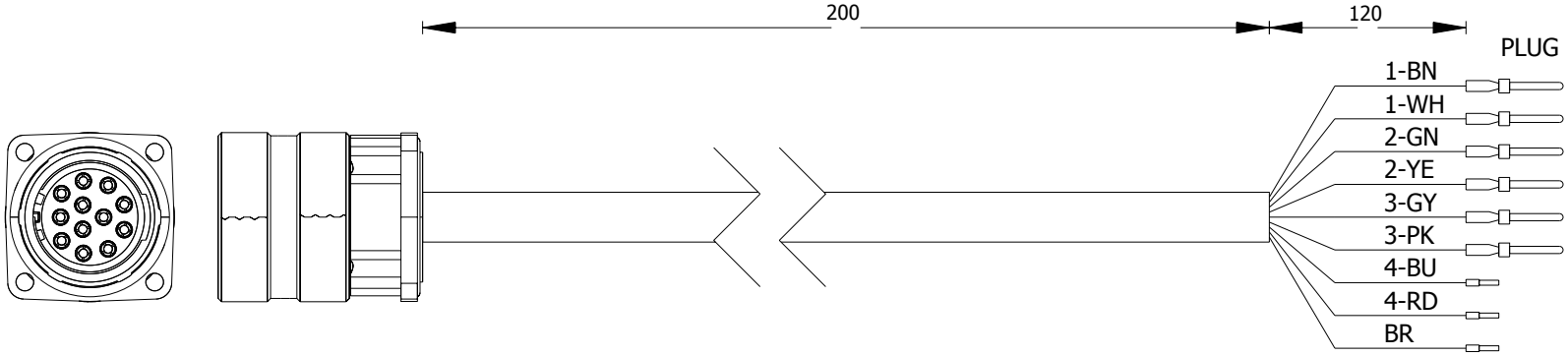
Cable diagram

Cable name	=+-W3		cable type	Lappkabel:0036026				
function text			no. of conductors	4G2.5+2x0.75mm		cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.4	-MP3	1	1	-XP	6	/2.4	
V	/2.4	-MP3	5	2	-XP	19	/2.4	
W	/2.4	-MP3	2	3	-XP	28	/2.4	
BK+	/2.3	-MP3	6	5	-XTM	5	/2.3	
BK-	/2.3	-MP3	4	6	-XTM	6	/2.3	
PE	/2.4	-MP3	PE	G/Y	-XP	8	/2.4	



Cable diagram

Cable name =+-W11			cable type Lappkabel:0035802					
function text			no. of conductors 4x2			cross-section 0.25mm		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.0	-MR1	1	1BN	-X4	5	/3.0	X7
S3	/3.1	-MR1	2	1WH	-X4	12	/3.1	0V X7
S4	/3.1	-MR1	3	2GN	-X4	4	/3.1	Y7
S2	/3.1	-MR1	4	2YE	-X4	11	/3.1	0V Y7
R2	/3.1	-MR1	6	3GY	-X4	2	/3.1	0V EXC2
R1	/3.1	-MR1	5	3PK	-X4	9	/3.1	EXC2
0VPTC	/3.0	-MR1	8	4BU	-XTP	2	/3.2	
PTC	/3.0	-MR1	7	4RD	-XTP	1	/3.0	
PE	/3.1	-MR1	E/9	SH	-XTP	PE	/3.1	



Cable diagram

Cable name	=+-W12		cable type	Lappkabel:0035802				
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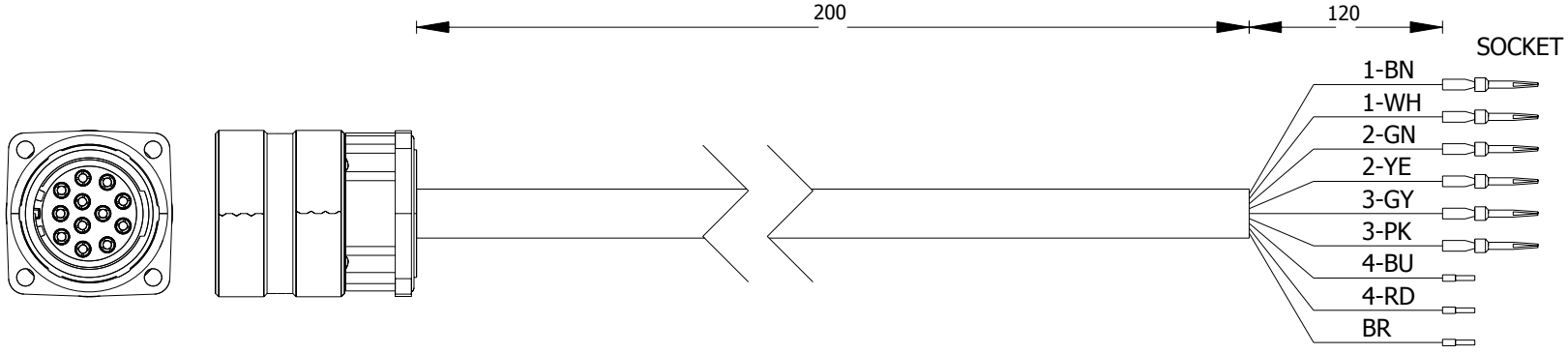
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.2	-MR2	1	1BN	-X2	4	/3.2	X2
S3	/3.2	-MR2	2	1WH	-X2	16	/3.2	0V X2
S4	/3.2	-MR2	3	2GN	-X2	5	/3.2	Y2
S2	/3.3	-MR2	4	2YE	-X2	17	/3.3	0V Y2
R2	/3.3	-MR2	6	3GY	-X2	7	/3.3	0V EXC1
R1	/3.3	-MR2	5	3PK	-X2	19	/3.3	EXC1
0VPTC	/3.2	-MR2	8	4BU	-XTP	3	/3.3	
PTC	/3.2	-MR2	7	4RD	-XTP	2	/3.2	
PE	/3.3	-MR2	E/9	SH	-XTP	PE	/3.3	



Cable diagram

Cable name	=+-W13		cable type	Lappkabel:0035802				
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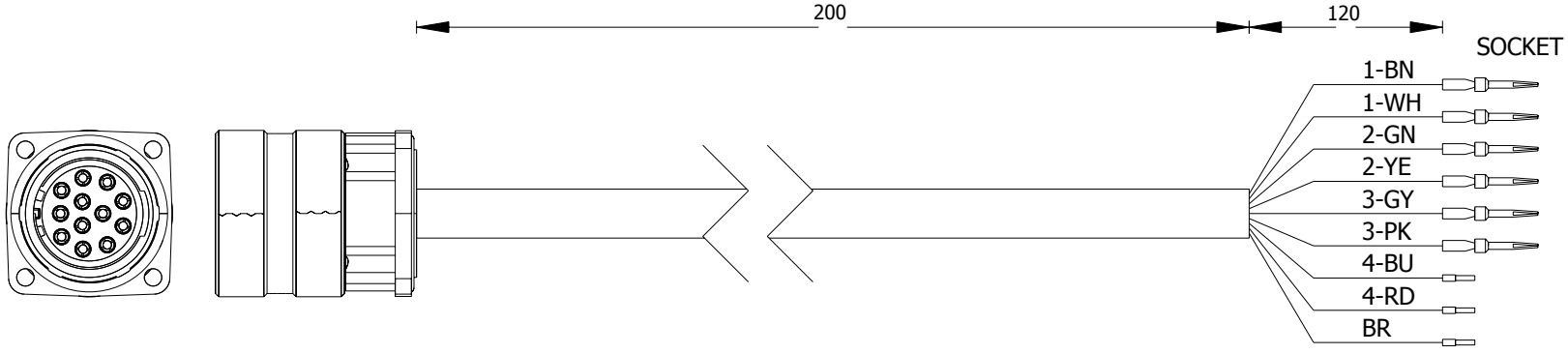
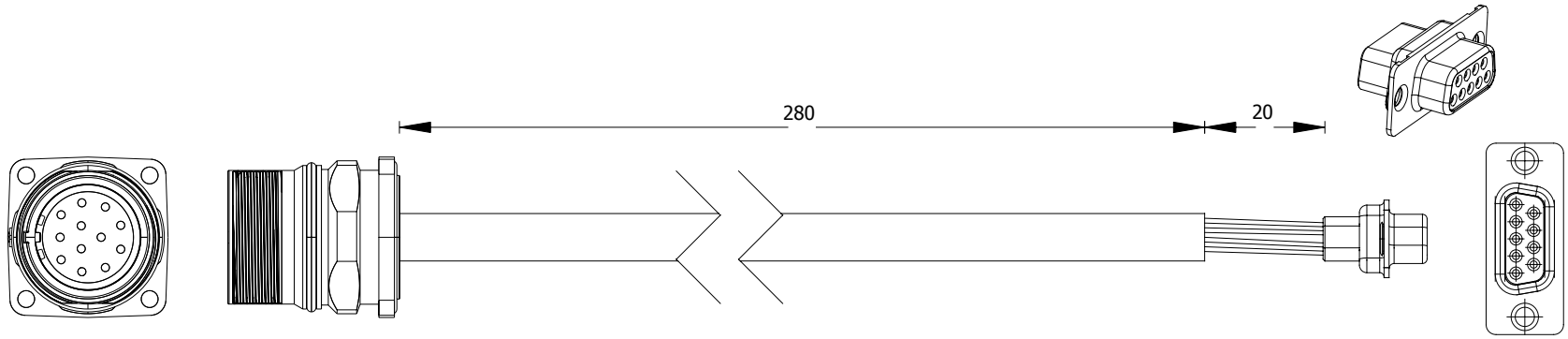
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.3	-MR3	1	1BN	-X2	9	/3.3	X3
S3	/3.3	-MR3	2	1WH	-X2	21	/3.3	0V X3
S4	/3.4	-MR3	3	2GN	-X2	10	/3.4	Y3
S2	/3.4	-MR3	4	2YE	-X2	22	/3.4	0V Y3
R2	/3.4	-MR3	6	3GY	-X2	8	/3.4	0V EXC1
R1	/3.4	-MR3	5	3PK	-X2	20	/3.4	EXC1
0VPTC	/3.3	-MR3	8	4BU	-XTP	4	/3.6	
PTC	/3.3	-MR3	7	4RD	-XTP	3	/3.3	
PE	/3.4	-MR3	E/9	SH	-XTP	PE	/3.3	



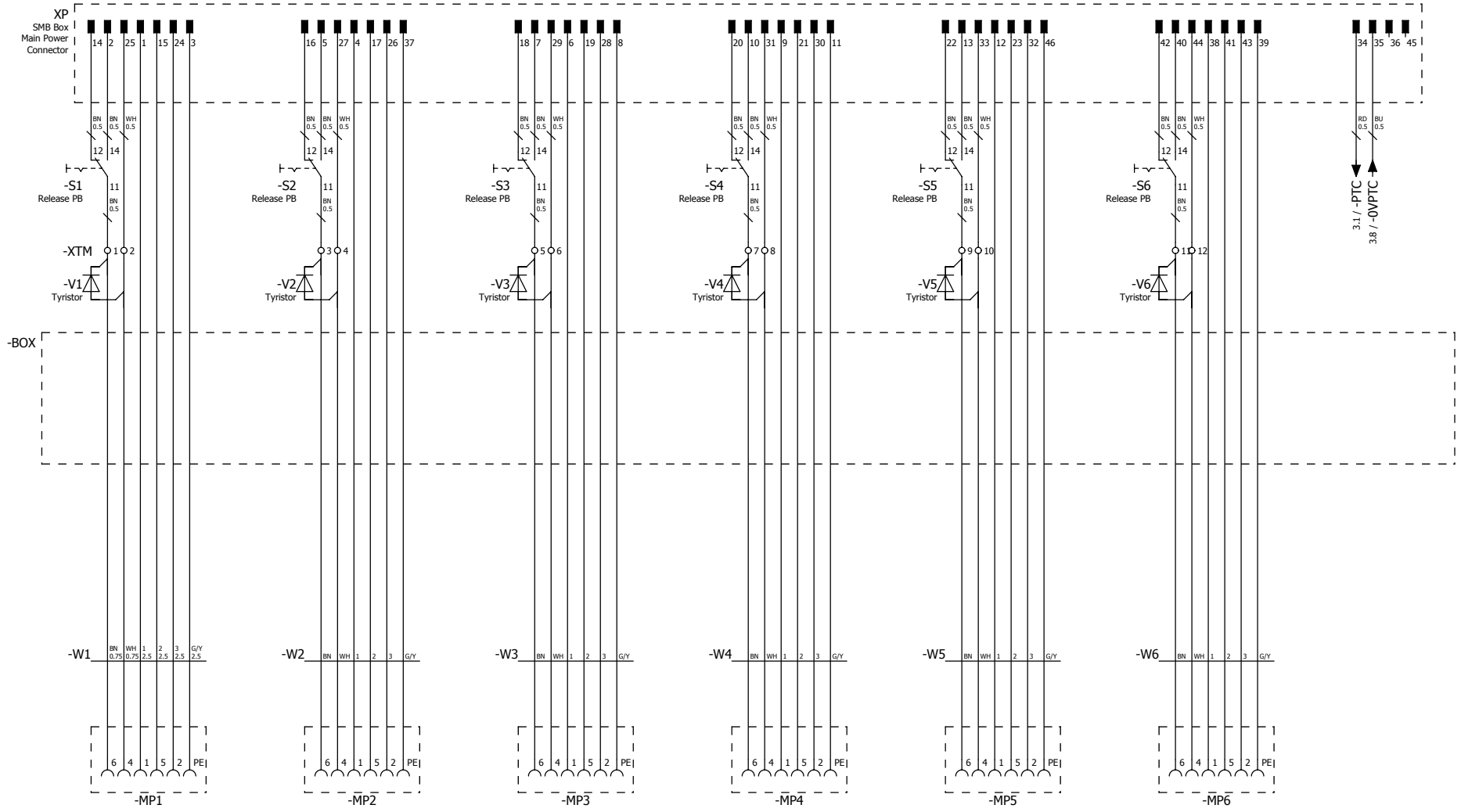
Cable diagram

Cable name =+-W21			cable type Lappkabel:0035802					
function text			no. of conductors 4x2			cross-section 0.25mm		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
SD1	/3.3	-XS	9	1BN	-X1	9	/3.3	SD1
SD1-N	/3.3	-XS	5	1WH	-X1	5	/3.3	SD1-N
SD0	/3.3	-XS	8	2GN	-X1	8	/3.3	SD0
SD0-N	/3.4	-XS	4	2YE	-X1	4	/3.4	SD0-N
0V	/3.4	-XS	3	3GY	-X1	3	/3.4	0V
24V	/3.4	-XS	7	3PK	-X1	7	/3.4	+24V
BAT+	/3.4	-XS	6	4BU	-X1	6	/3.4	+BATT
0V BAT	/3.4	-XS	2	4RD	-X1	2	/3.4	0VBAT

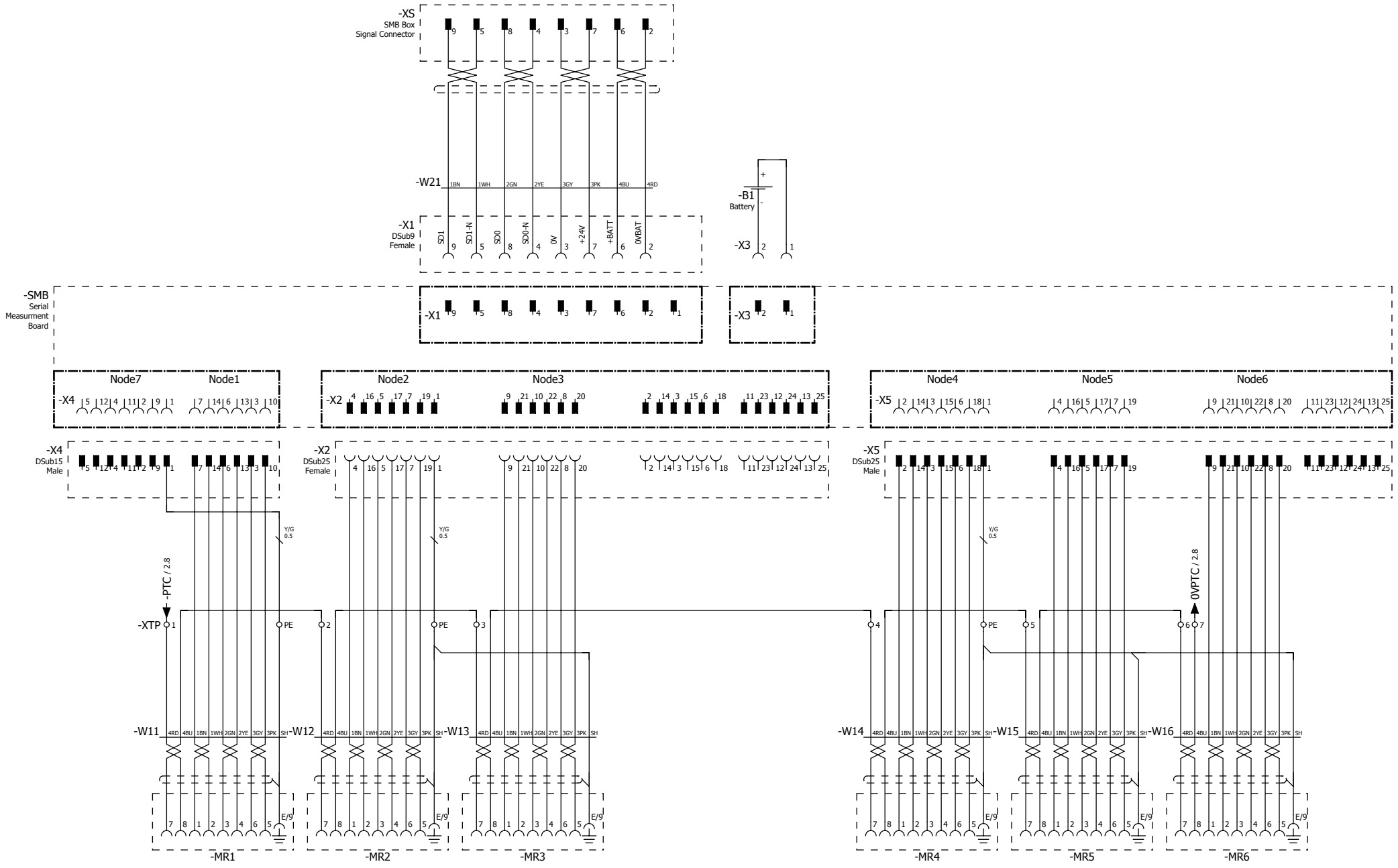


Project Discription	SMB Box For 6 Axis M2011
Document Number	3HAW050008651
Revision	002

Number of pages 28

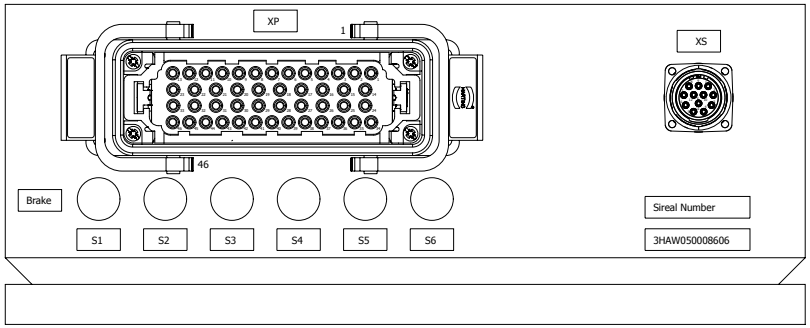


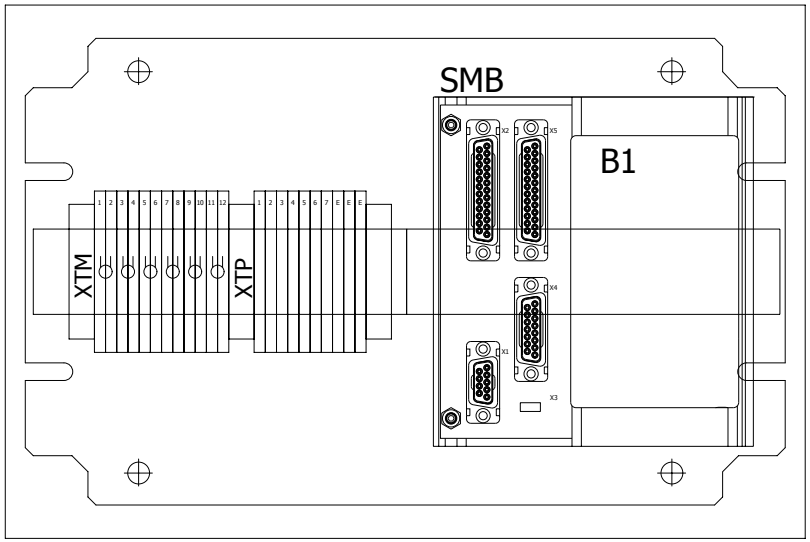
Respsonsible Department: RS/BIW		SMB Box For 6 Axis M2011		Power	Status: Approved 2012-9-15
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-9-15	Replacement of	Replaced by		Document no. 3HAW050008651 Rev.Ind 002 Page 2 Total Page 28

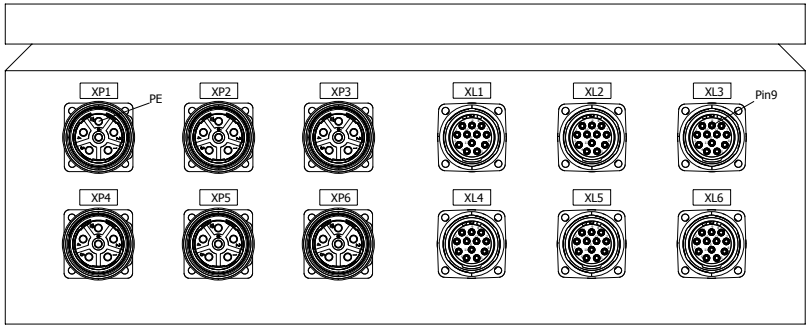


Respsonsible Department: RS/BIW		SMB Box For 6 Axis M2011		Signal	Status: Approved 2012-9-15
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-9-15	Replacement of	Replaced by		Document no. 3HAW050008651 Rev.Ind 002 Page 3 Total Page 28

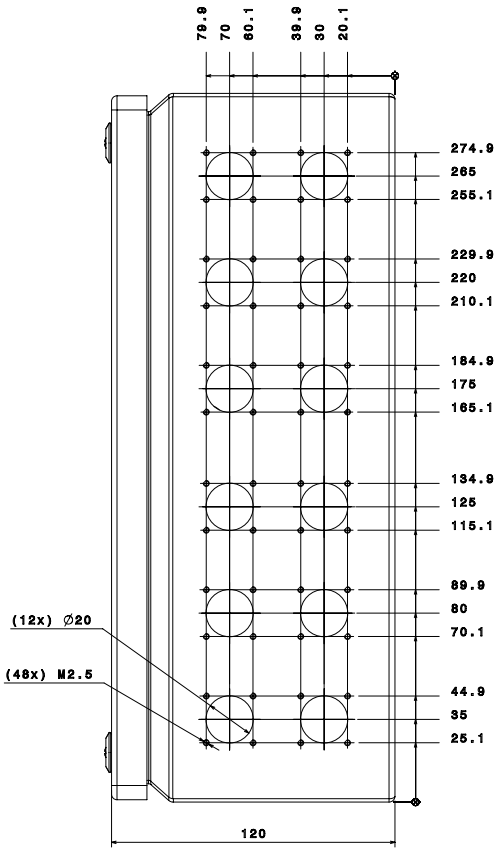
Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes

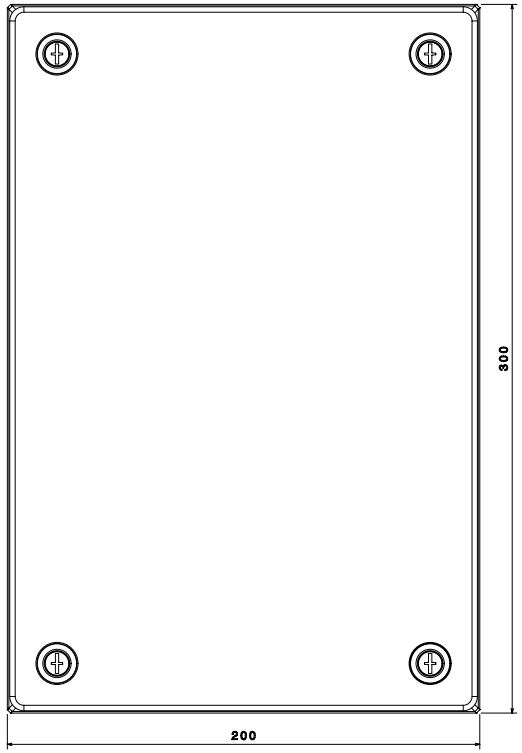


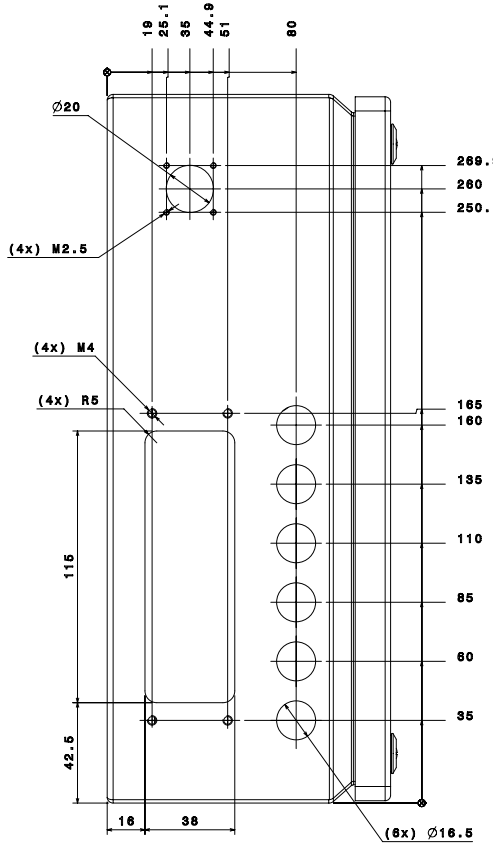


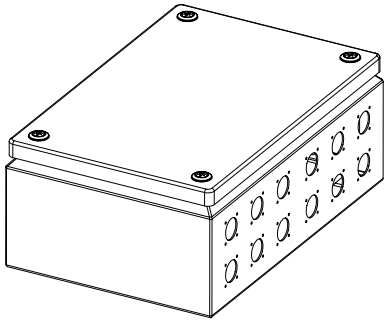


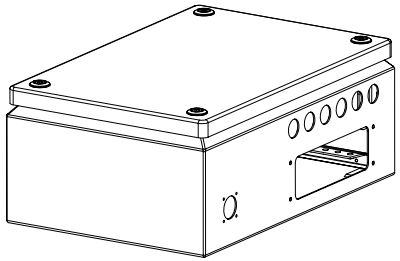
Respsonsible Department: RS/BIW		SMB Box For 6 Axis M2011		Status: Approved 2012-9-15	= +
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-9-15	Replacement of	Replaced by	Layout	Document no. 3HAW050008651 / Rev.Ind 002 / Page 4 / Total Page 28







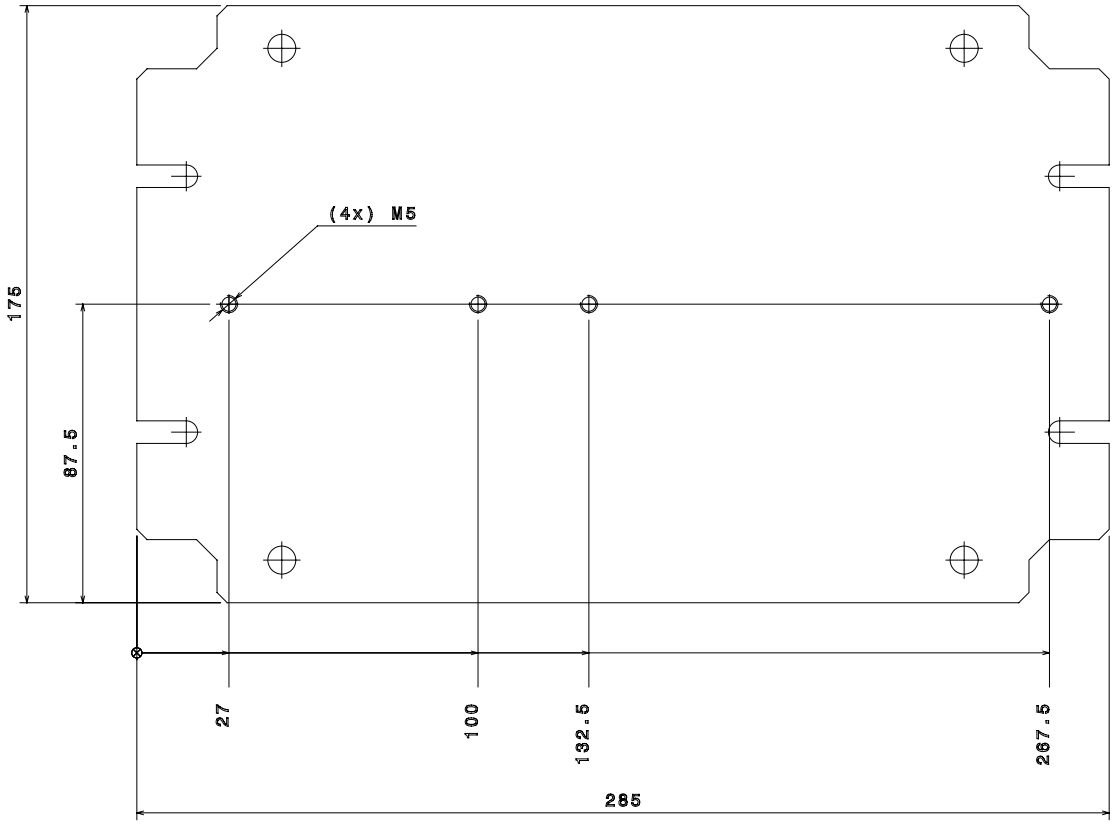




TOLERANCES GENERALES GENERALS TOLERANCES Sauf indication contraire Unless otherwise indicated				
	BRUT STOCK MATERIAL	R25	R12.5	R6.3
0 --> 120	± 1	± 0.25	± 0.20	± 0.15
120 --> 400	± 1.25	± 0.35	± 0.30	± 0.20
> 400	± 1.60	± 0.50	± 0.40	± 0.30
	⊥	//	▱	
USINE MACHINED	0.2/1000	0.2/1000	0.8/1000	
BRUT STOCK MATERIAL	2/1000	2/1000	2.5/1000	

Echelle Scale	1/1
Format	A1
Designation: pièce, sous ensemble ou ensemble . Description: part, sub assembly or assembly.	-
	-
	6-Axis SMB Box
Chemin CAO: Dwg file identity:	-
Date:	26/03/2011
Dessiné par: Drawn by:	Zhang Huiyun
Vise: Approved:	-
Matière Material	KL1508.510
Traitement Treatment	-
Brut Stock	500 X 500 X 120
ABB Engineer Ltd. Shanghai	
Système CAO CAD system	CATIA V5
	-
KL1503.510-SMB-Box-6	
Planche Sheet	1/1

Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes



TOLERANCES GENERALES GENERALS TOLERANCES Sauf indication contraire Unless otherwise indicated	BRUT STOCK MATERIAL	R25	R12.5	R6.3
0 --> 150	± 1	± 0.25	± 0.20	± 0.15
150 --> 400	± 1.25	± 0.35	± 0.30	± 0.20
> 400	± 1.50	± 0.50	± 0.40	± 0.30

	⊥	//	▱
USINE MACHINED	0.2/1000	0.2/1000	0.3/1000
BRUT STOCK MATERIAL	2/1000	2/1000	2.5/1000

Echelle Scale	1/1	Designation: piece, sous ensemble ou ensemble . Description: part, sub assembly or assembly.
		--
		--
Format	A2	Holes drilled after SMB Box

ABB Engineer Ltd.
Shanghai

ABB SACE
No.5,Lane 369,
Chuangye Road,
Kangqiao Town,
Shanghai,P.R.China
Tel:+86 21 61056579

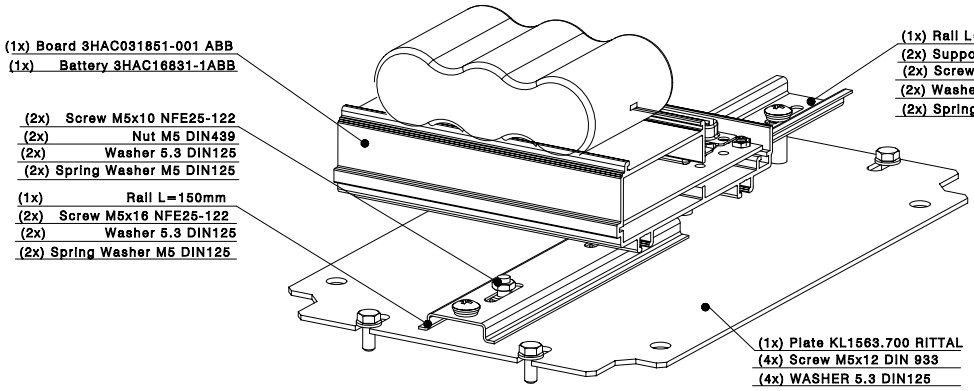
Chemin CAO: Dwg file identify:	-
Date:	28/03/2011
Dessine par: Drawn by:	Zhang Hulyun
Vise: Approved:	-

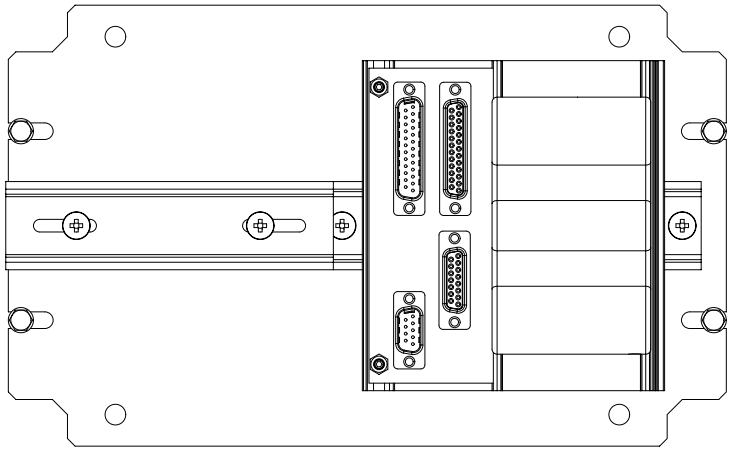
Matiere Material	KL1563.700
Traitement Treatment	-
Brut Stock	-
Systeme CAO: CAD system:	CATIA V5
Planche Sheet	1/1

KL1563.700

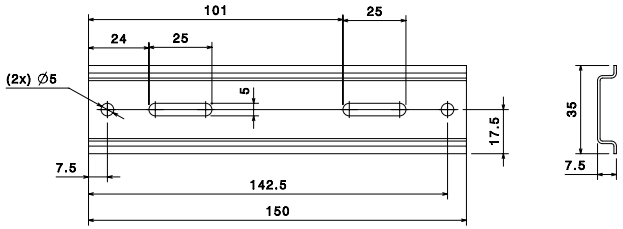
4.a 4.c

Respsonsible Department: RS/BIW		SMB Box For 6 Axis M2011		Status: Approved 2012-9-15	= +
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-9-15	Replacement of	Replaced by	Plate Drill Hole	Document no. 3HAW050008651 Rev.Ind 002 Page 4.b Total Page 28

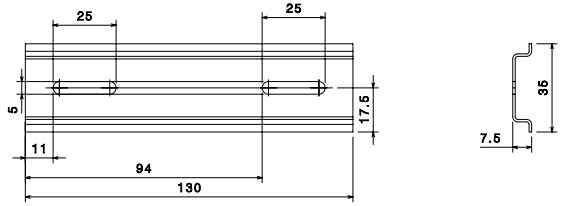




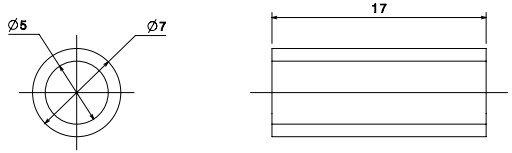
Rail L=150mm



Rail L=130mm



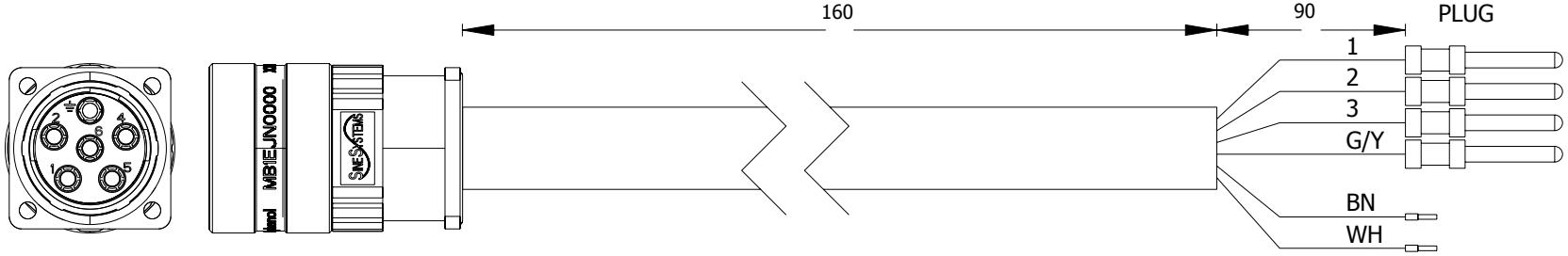
Support 7x5x17



Respsonsible Department: RS/BIW		SMB Box For 6 Axis M2011	ABB	Rail Installation On Plate	Status: Approved 2012-9-15
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-9-15	Replacement of	Replaced by		Document no. 3HAW050008651 Rev.Ind 002 Page 4.c Total Page 28

Cable diagram

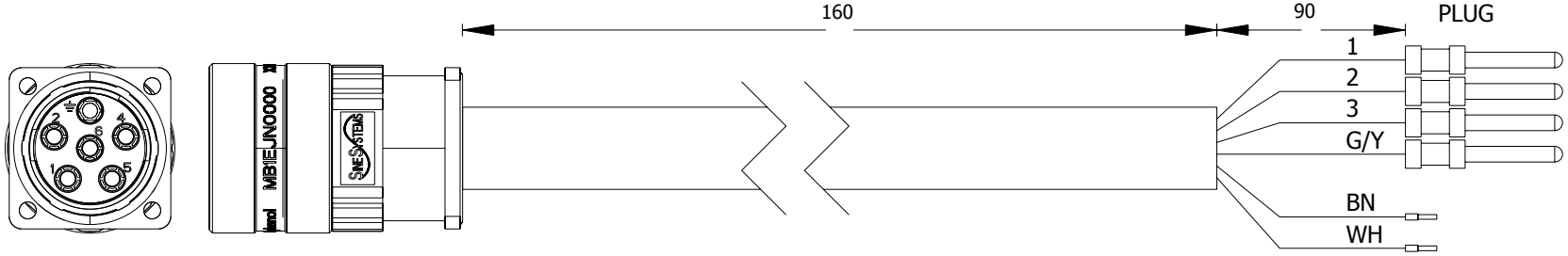
Cable name	=+-W1		cable type	Lappkabel:0036026				
function text			no. of conductors	4G2.5+2x0.75mm		cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.1	-MP1	1	1	-XP	1	/2.1	
V	/2.1	-MP1	5	2	-XP	15	/2.1	
W	/2.1	-MP1	2	3	-XP	24	/2.1	
BK+	/2.1	-MP1	6	BN	-XTM	1	/2.1	
PE	/2.1	-MP1	PE	G/Y	-XP	3	/2.1	
BK-	/2.1	-MP1	4	WH	-XTM	2	/2.1	



Respsonsible Department: RS/BIW		SMB Box For 6 Axis M2011		Cable diagram =+-W1	Status: Approved 2012-9-15	= +
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-9-15	Replacement of	Replaced by		Document no. 3HAW050008651	Rev.Ind 002
						Page 10 / Total Page 28

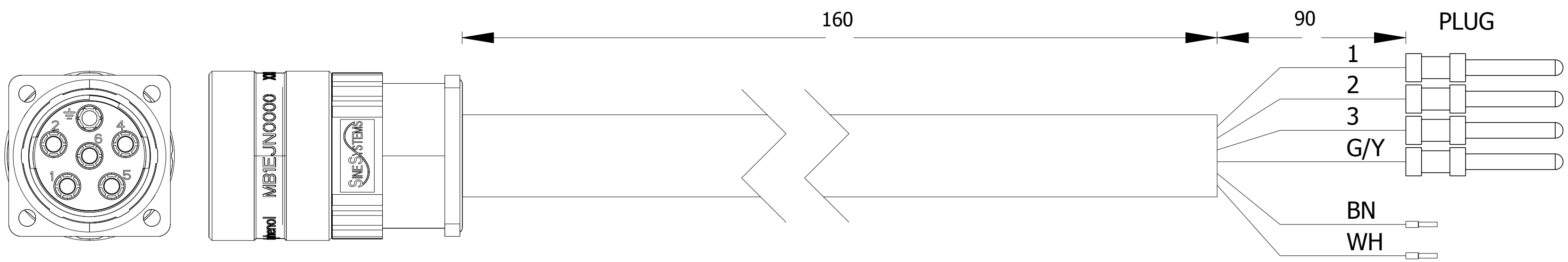
Cable diagram

Cable name	=+-W2		cable type	Lappkabel:0036026				
function text			no. of conductors	4G2.5+2x0.75mm		cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.2	-MP2	1	1	-XP	4	/2.2	
V	/2.2	-MP2	5	2	-XP	17	/2.2	
W	/2.2	-MP2	2	3	-XP	26	/2.2	
BK+	/2.2	-MP2	6	BN	-XTM	3	/2.2	
PE	/2.3	-MP2	PE	G/Y	-XP	37	/2.3	
BK-	/2.2	-MP2	4	WH	-XTM	4	/2.2	



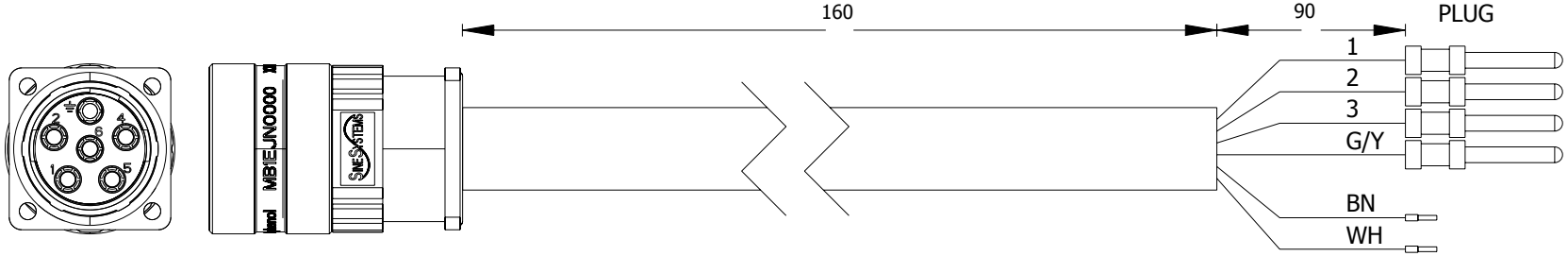
Cable diagram

Cable name =+-W3			cable type Lappkabel:0036026					
function text			no. of conductors 4G2.5+2x0.75mm			cross-section	Length 0.3	
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.4	-MP3	1	1	-XP	6	/2.4	
V	/2.4	-MP3	5	2	-XP	19	/2.4	
W	/2.4	-MP3	2	3	-XP	28	/2.4	
BK+	/2.3	-MP3	6	BN	-XTM	5	/2.3	
PE	/2.4	-MP3	PE	G/Y	-XP	8	/2.4	
BK-	/2.3	-MP3	4	WH	-XTM	6	/2.3	



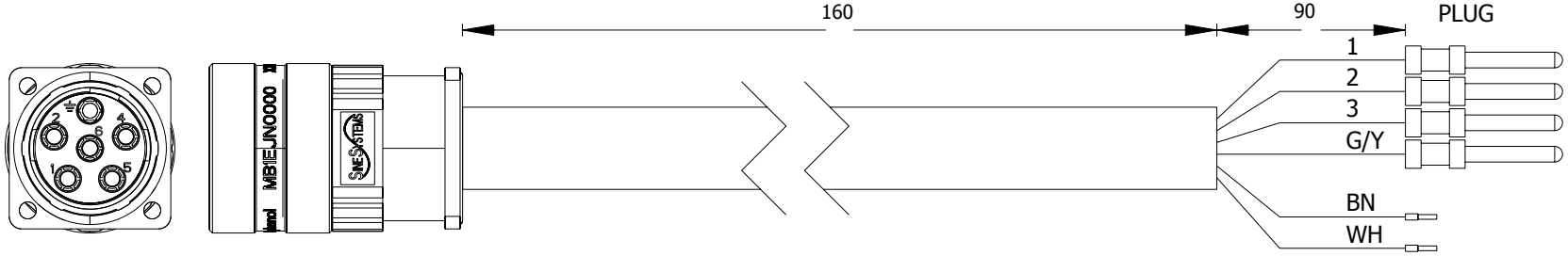
Cable diagram

Cable name	=+-W4		cable type	Lappkabel:0036026				
function text			no. of conductors	4G2.5+2x0.75mm		cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.5	-MP4	1	1	-XP	9	/2.5	
V	/2.5	-MP4	5	2	-XP	21	/2.5	
W	/2.5	-MP4	2	3	-XP	30	/2.5	
BK+	/2.5	-MP4	6	BN	-XTM	7	/2.5	
PE	/2.5	-MP4	PE	G/Y	-XP	11	/2.5	
BK-	/2.5	-MP4	4	WH	-XTM	8	/2.5	



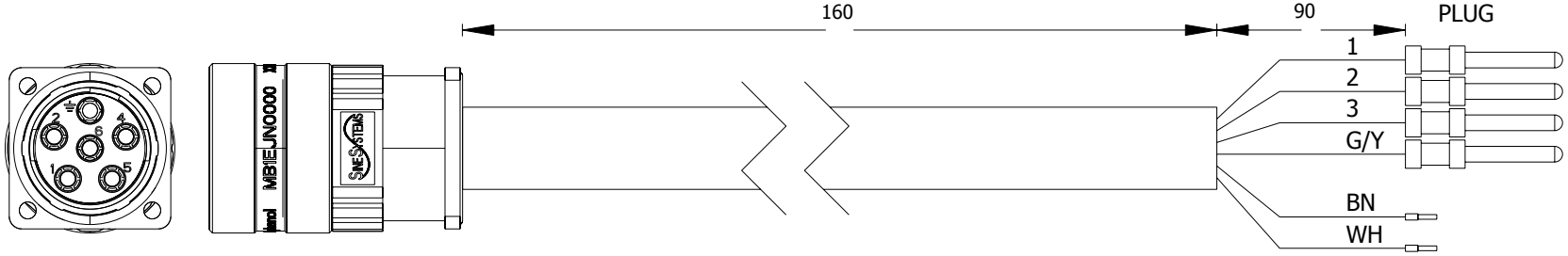
Cable diagram

Cable name	=+-W5		cable type	Lappkabel:0036026				
function text			no. of conductors	4G2.5+2x0.75mm		cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.6	-MP5	1	1	-XP	12	/2.6	
V	/2.6	-MP5	5	2	-XP	23	/2.6	
W	/2.6	-MP5	2	3	-XP	32	/2.6	
BK+	/2.6	-MP5	6	BN	-XTM	9	/2.6	
PE	/2.6	-MP5	PE	G/Y	-XP	46	/2.6	
BK-	/2.6	-MP5	4	WH	-XTM	10	/2.6	



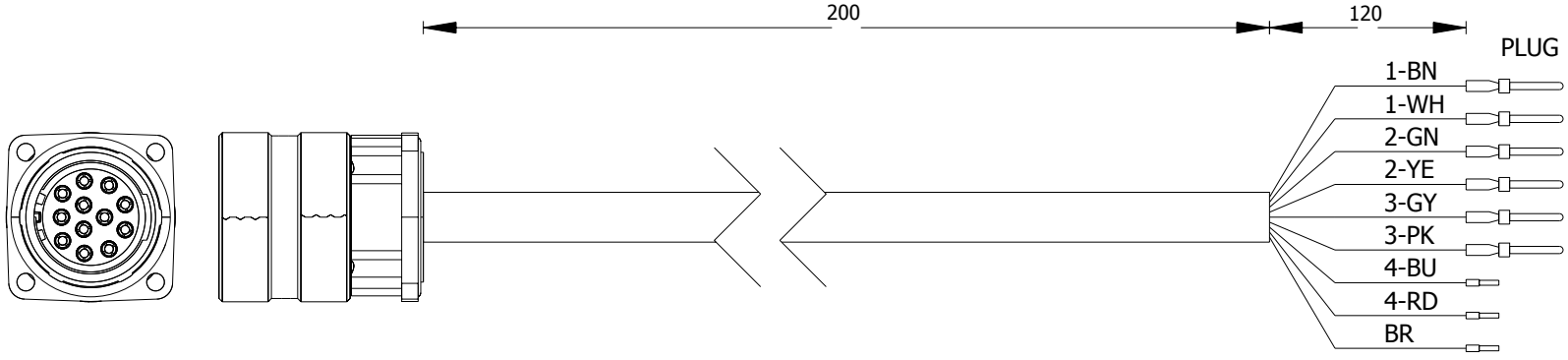
Cable diagram

Cable name	=+-W6		cable type	Lappkabel:0036026				
function text			no. of conductors	4G2.5+2x0.75mm		cross-section		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
U	/2.7	-MP6	1	1	-XP	38	/2.7	
V	/2.7	-MP6	5	2	-XP	41	/2.7	
W	/2.7	-MP6	2	3	-XP	43	/2.7	
BK+	/2.7	-MP6	6	BN	-XTM	11	/2.7	
PE	/2.8	-MP6	PE	G/Y	-XP	39	/2.8	
BK-	/2.7	-MP6	4	WH	-XTM	12	/2.7	



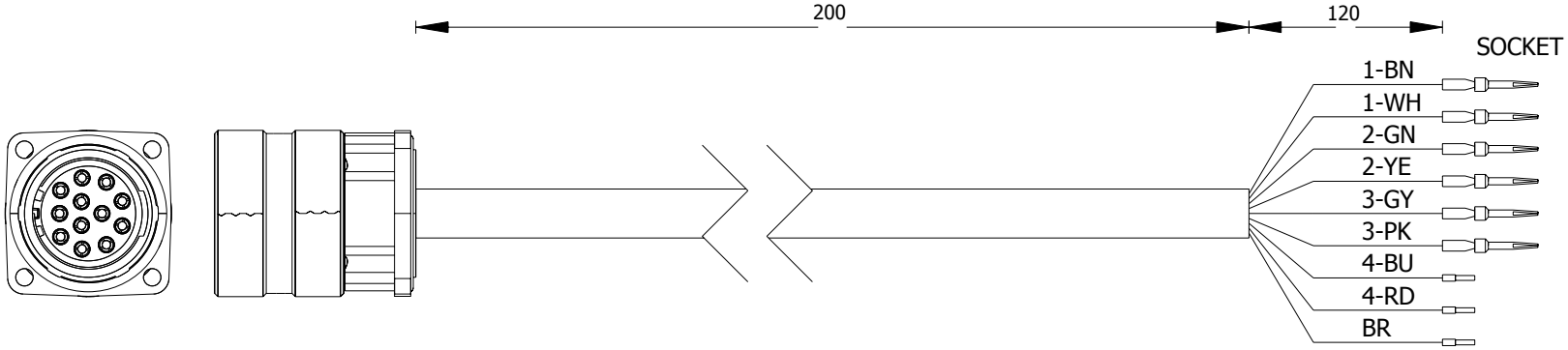
Cable diagram

Cable name =+-W11			cable type Lappkabel:0035802					
function text			no. of conductors 4x2			cross-section 0.25mm		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.1	-MR1	1	1BN	-X4	7	/3.1	X1
S3	/3.1	-MR1	2	1WH	-X4	14	/3.1	0V X1
S4	/3.1	-MR1	3	2GN	-X4	6	/3.1	Y1
S2	/3.2	-MR1	4	2YE	-X4	13	/3.2	0V Y1
R2	/3.2	-MR1	6	3GY	-X4	3	/3.2	0V EXC1
R1	/3.2	-MR1	5	3PK	-X4	10	/3.2	EXC1
0VPTC	/3.1	-MR1	8	4BU	-XTP	2	/3.2	
PTC	/3.1	-MR1	7	4RD	-XTP	1	/3.1	
PE	/3.2	-MR1	E/9	SH	-XTP	PE	/3.2	



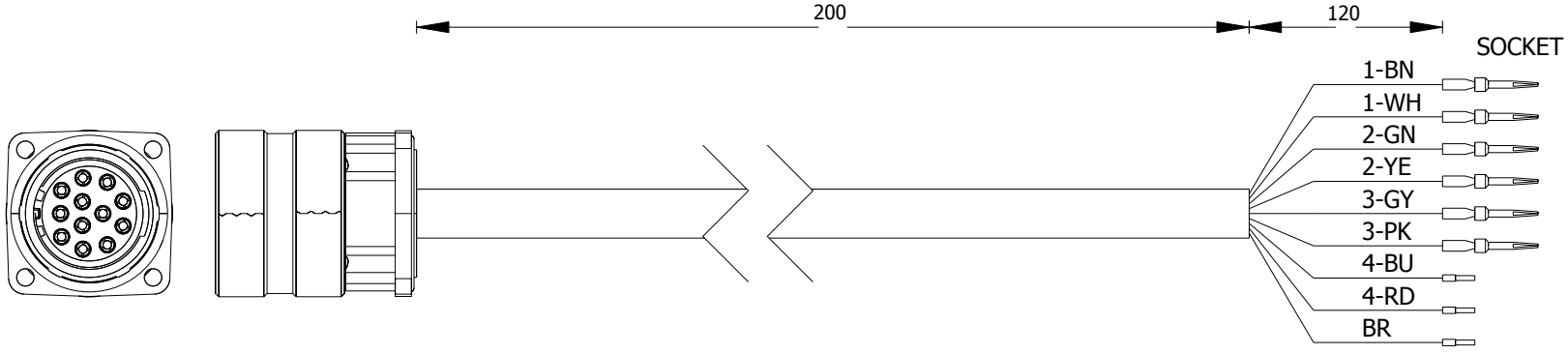
Cable diagram

Cable name	=+-W12		cable type	Lappkabel:0035802				
function text			no. of conductors	4x2		cross-section 0.25mm		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.2	-MR2	1	1BN	-X2	4	/3.2	X2
S3	/3.2	-MR2	2	1WH	-X2	16	/3.2	0V X2
S4	/3.2	-MR2	3	2GN	-X2	5	/3.2	Y2
S2	/3.3	-MR2	4	2YE	-X2	17	/3.3	0V Y2
R2	/3.3	-MR2	6	3GY	-X2	7	/3.3	0V EXC1
R1	/3.3	-MR2	5	3PK	-X2	19	/3.3	EXC1
0VPTC	/3.2	-MR2	8	4BU	-XTP	3	/3.3	
PTC	/3.2	-MR2	7	4RD	-XTP	2	/3.2	
PE	/3.3	-MR2	E/9	SH	-XTP	PE	/3.3	



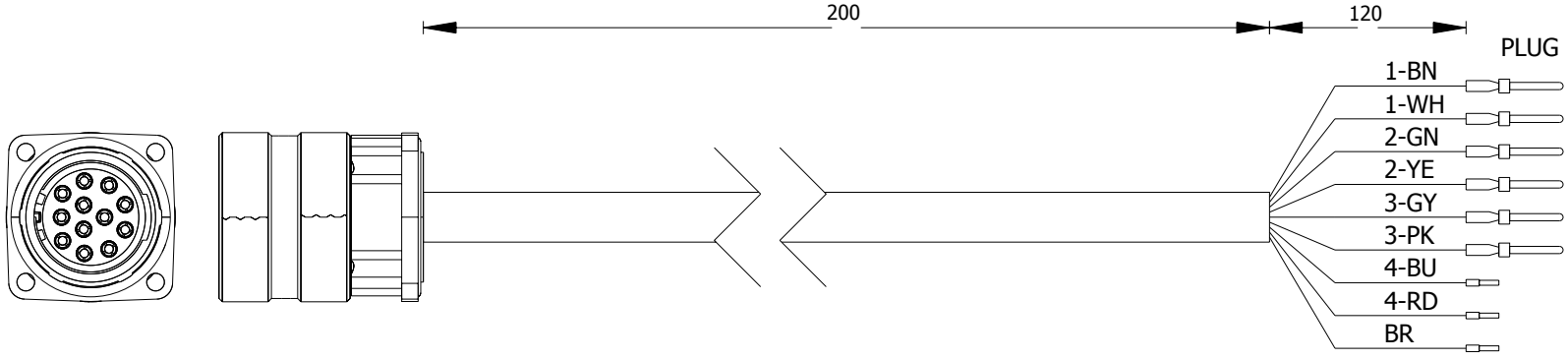
Cable diagram

Cable name	=+-W13		cable type	Lappkabel:0035802				
function text			no. of conductors	4x2		cross-section 0.25mm		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.3	-MR3	1	1BN	-X2	9	/3.3	X3
S3	/3.3	-MR3	2	1WH	-X2	21	/3.3	0V X3
S4	/3.4	-MR3	3	2GN	-X2	10	/3.4	Y3
S2	/3.4	-MR3	4	2YE	-X2	22	/3.4	0V Y3
R2	/3.4	-MR3	6	3GY	-X2	8	/3.4	0V EXC1
R1	/3.4	-MR3	5	3PK	-X2	20	/3.4	EXC1
0VPTC	/3.3	-MR3	8	4BU	-XTP	4	/3.6	
PTC	/3.3	-MR3	7	4RD	-XTP	3	/3.3	
PE	/3.4	-MR3	E/9	SH	-XTP	PE	/3.3	



Cable diagram

Cable name	=+-W14		cable type	Lappkabel:0035802				
function text			no. of conductors	4x2		cross-section 0.25mm		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.6	-MR4	1	1BN	-X5	2	/3.6	X4
S3	/3.6	-MR4	2	1WH	-X5	14	/3.6	0V X4
S4	/3.6	-MR4	3	2GN	-X5	3	/3.6	Y4
S2	/3.6	-MR4	4	2YE	-X5	15	/3.6	0V Y4
R2	/3.6	-MR4	6	3GY	-X5	6	/3.6	0VEXC2
R1	/3.6	-MR4	5	3PK	-X5	18	/3.6	EXC2
0VPTC	/3.6	-MR4	8	4BU	-XTP	5	/3.7	
PTC	/3.6	-MR4	7	4RD	-XTP	4	/3.6	
PE	/3.7	-MR4	E/9	SH	-XTP	PE	/3.7	



Cable diagram

Cable name	=+-W15		cable type	Lappkabel:0035802				
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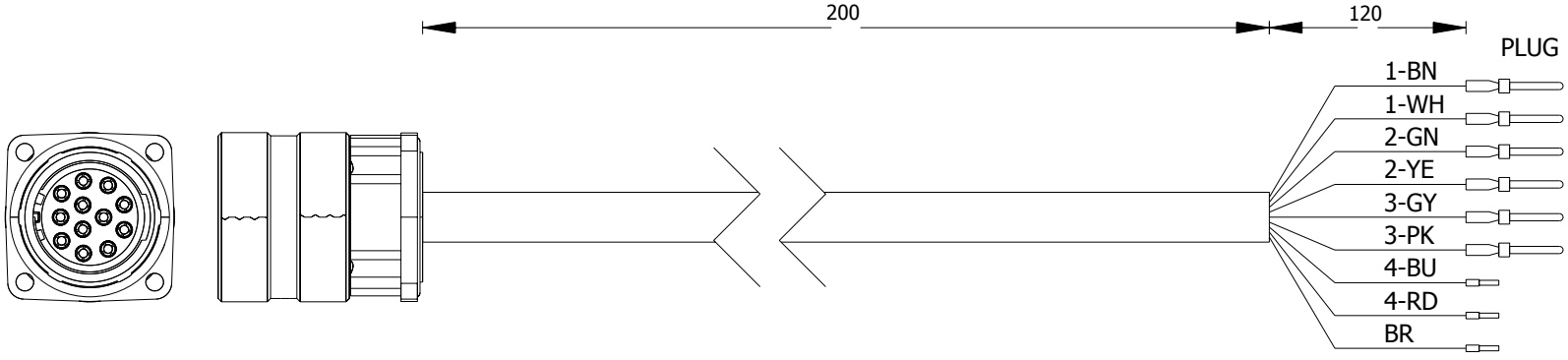
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.7	-MR5	1	1BN	-X5	4	/3.7	X5
S3	/3.7	-MR5	2	1WH	-X5	16	/3.7	0V X5
S4	/3.7	-MR5	3	2GN	-X5	5	/3.7	Y5
S2	/3.7	-MR5	4	2YE	-X5	17	/3.7	0V Y5
R2	/3.7	-MR5	6	3GY	-X5	7	/3.7	0V EXC2
R1	/3.8	-MR5	5	3PK	-X5	19	/3.8	EXC2
0VPTC	/3.7	-MR5	8	4BU	-XTP	6	/3.8	
PTC	/3.7	-MR5	7	4RD	-XTP	5	/3.7	
PE	/3.8	-MR5	E/9	SH	-XTP	PE	/3.7	



Cable diagram

Cable name	=+-W16		cable type	Lappkabel:0035802				
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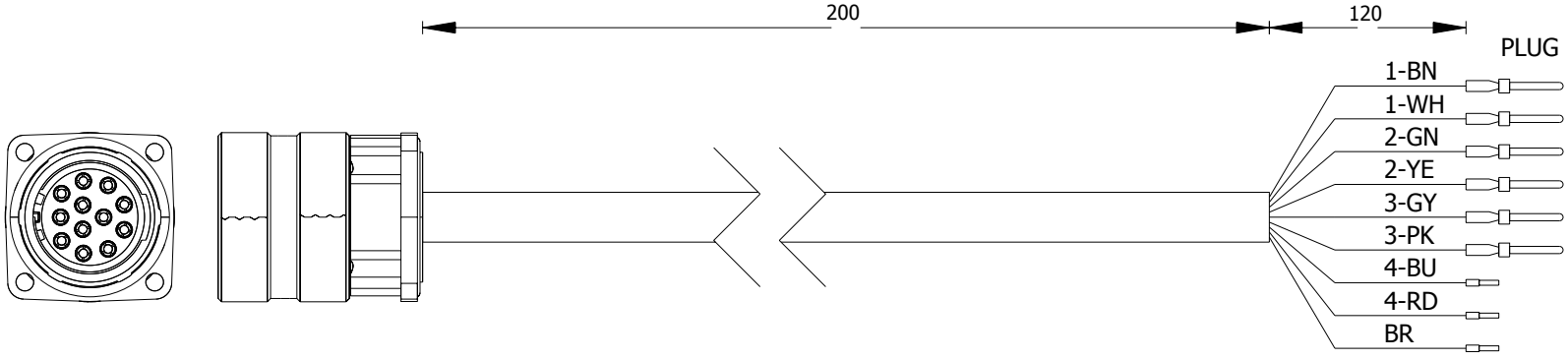
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
S1	/3.8	-MR6	1	1BN	-X5	9	/3.8	X6
S3	/3.8	-MR6	2	1WH	-X5	21	/3.8	0V X6
S4	/3.8	-MR6	3	2GN	-X5	10	/3.8	Y6
S2	/3.8	-MR6	4	2YE	-X5	22	/3.8	0V Y6
R2	/3.8	-MR6	6	3GY	-X5	8	/3.8	0V EXC2
R1	/3.9	-MR6	5	3PK	-X5	20	/3.9	EXC2
0VPTC	/3.8	-MR6	8	4BU	-XTP	7	/3.8	
PTC	/3.8	-MR6	7	4RD	-XTP	6	/3.8	
PE	/3.9	-MR6	E/9	SH	-XTP	PE	/3.7	



Cable diagram

Cable name =+-W21			cable type Lappkabel:0035802					
function text			no. of conductors 4x2			cross-section 0.25mm		Length 0.3
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
SD1	/3.3	-XS	9	1BN	-X1	9	/3.3	SD1
SD1-N	/3.3	-XS	5	1WH	-X1	5	/3.3	SD1-N
SD0	/3.3	-XS	8	2GN	-X1	8	/3.3	SD0
SD0-N	/3.4	-XS	4	2YE	-X1	4	/3.4	SD0-N
0V	/3.4	-XS	3	3GY	-X1	3	/3.4	0V
24V	/3.4	-XS	7	3PK	-X1	7	/3.4	+24V
BAT+	/3.4	-XS	6	4BU	-X1	6	/3.4	+BATT
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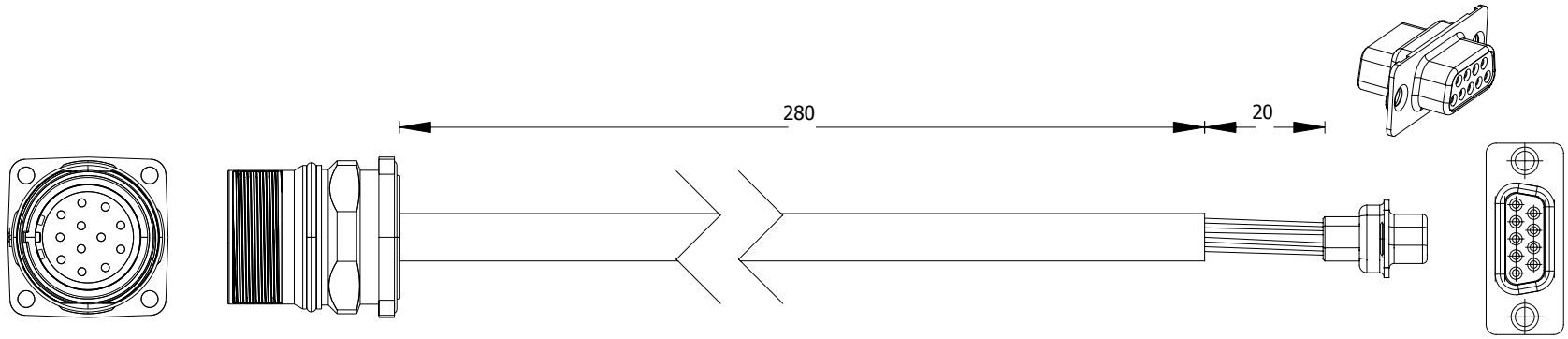


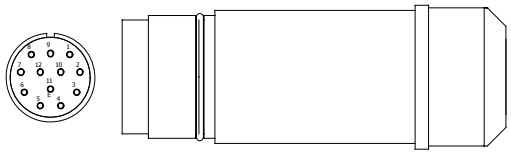
Respsonsible Department: RS/BIW		SMB Box For 6 Axis M2011	ABB	Cable diagram =+-W21	Status: Approved 2012-9-15
Prepare by, Date N,Cao 2013-2-25	Approve by,Date A,Stapelberg 2012-9-15	Replacement of	Replaced by		Document no. 3HAW050008651 Rev.Ind 002 Page 22 Total Page 28

Project Discription	PTC Shunt
Document Number	3HAW050008607
Revision	003

Number of pages 6

0	1	2	3	4	5	6	7	8	9

Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes
Technical Provisions	TP	3HAB8053-1	Manufact Moving Cable



3HAW050008607

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		PTC Shunt		Layout	Status: Approved 2011-10-10
Respsonsible Department: RS / BIW					Document no. 3HAW050008607
Prepare by, Date N,Cao 2011-10-24	Approve by, Date A,Stapelberg 2011-10-10	Replacement of	Replaced by		Rev.Ind 003

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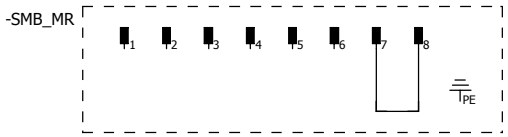
Page	2
Total Page	6

SMB Box
Motor
Resolver



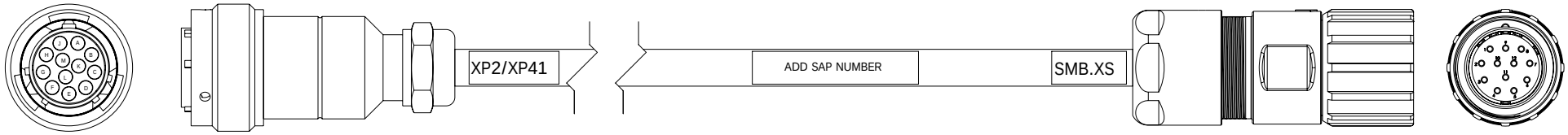
		PTC Shunt		Connection	Status: Approved 2011-10-10
Respsonsible Department: RS / BIW					Document no. 3HAW050008607
Prepare by, Date N,Cao 2011-10-24	Approve by, Date A,Stapelberg 2011-10-10	Replacement of	Replaced by		Rev.Ind 003

Page 3
Total Page 6

Project Discription	6 Resolver FlexCable IRC5.XP2 - SMB.XS
Document Number	3HAW050008612-XXX
Revision	003

Number of pages 8

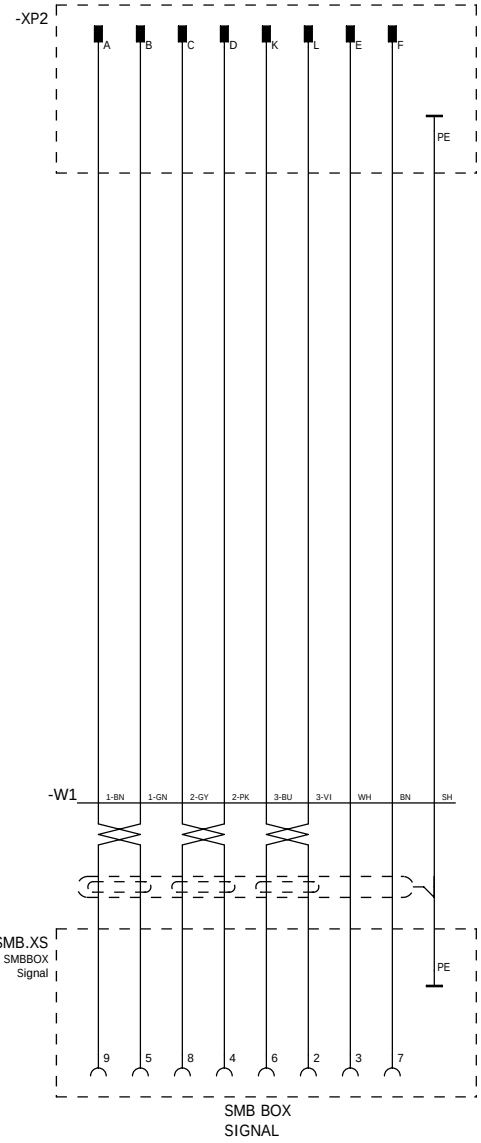
Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes
Technical Provisions	TP	3HAB8053-1	Manufact Moving Cable



SAP NUMBER	Length
3HAW050008612-005	5M
3HAW050008612-010	10M
3HAW050008612-015	15M
3HAW050008612-020	20M
3HAW050008612-025	25M

	6 Resolver FlexCable IRC5.XP2 - SMB.XS		Layout	Status: Approved	=	
Respsonsible Department: RS / BIW					+	
Prepare by, Date N,Cao 2014/8/25	Approve by,Date	Replacement of	Replaced by	Document no. 3HAW050008612-XXX	Rev.Ind 003	Page 2 / Total Page 8

IRC5 Cabinet
XS2 / XS41



SMB BOX
SIGNAL

	6 Resolver FlexCable IRC5.XP2 - SMB.XS		Connection	Status: Approved	=	
Respsonsible Department: RS / BIW				Document no. 3HAW050008612-XXX	Rev.Ind 003	Page 3
Prepare by, Date N,Cao 2014/8/25	Approve by,Date	Replacement of / Replaced by				Total Page 8

Cable diagram

F09_002_ABB

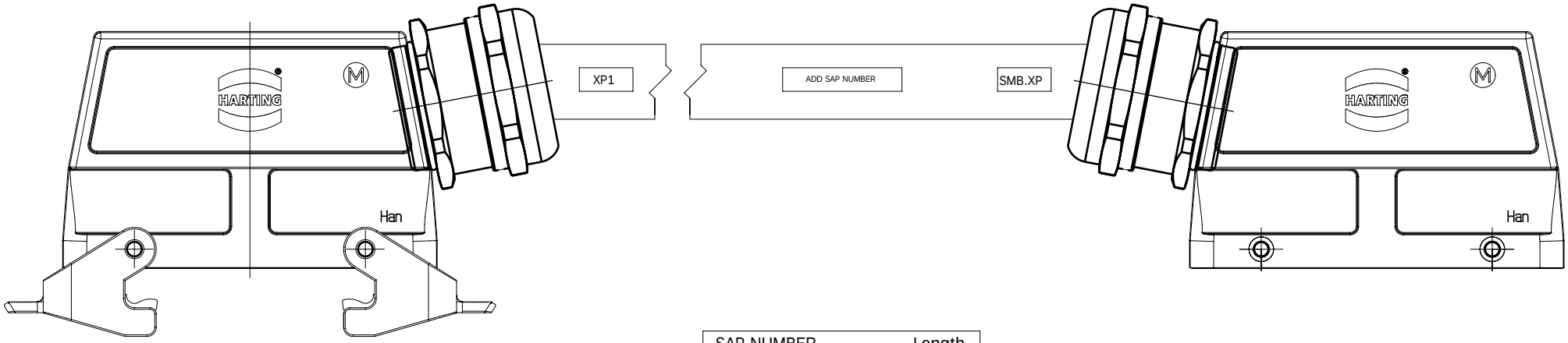
Cable name	=+-W1		cable type	INTERCOND:13MYI 21Z 10P				
function text			no. of conductors	4x2x0.25mm+2x0.5mm		cross-section		Length
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
SDI	/3.1	-SMB.XS	9	1-BN	-XP2	A	/3.1	SDI
SDI-N	/3.1	-SMB.XS	5	1-GN	-XP2	B	/3.1	SDI-N
SDO	/3.1	-SMB.XS	8	2-GY	-XP2	C	/3.1	SDO
SDO-N	/3.1	-SMB.XS	4	2-PK	-XP2	D	/3.1	SDO-N
BATSUP	/3.2	-SMB.XS	6	3-BU	-XP2	K	/3.2	BATSUP
BATLD	/3.2	-SMB.XS	2	3-VI	-XP2	L	/3.2	BATLD
24V	/3.2	-SMB.XS	7	BN	-XP2	F	/3.2	24V
	/3.2	-SMB.XS	PE	SH	-XP2	PE	/3.2	
0V	/3.2	-SMB.XS	3	WH	-XP2	E	/3.2	0V

3 5

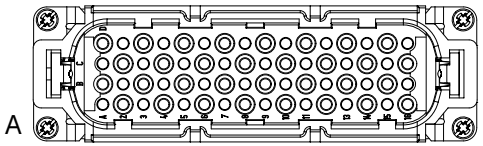
Project Discription	6 MotorPower StaticCable LowVoltage IRC5.XP1 to SMB.XP 64D 24B to 46EE 24B 500V
Document Number	3HAW050008616-XXX
Revision	003

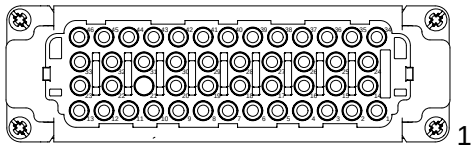
Number of pages 8

Supplementary Document	Doc Type	Document	Description
Technical Provisions	TP	3HAB8053-1	Barcodes
Technical Provisions	TP	3HAB8053-1	Manufact Moving Cable



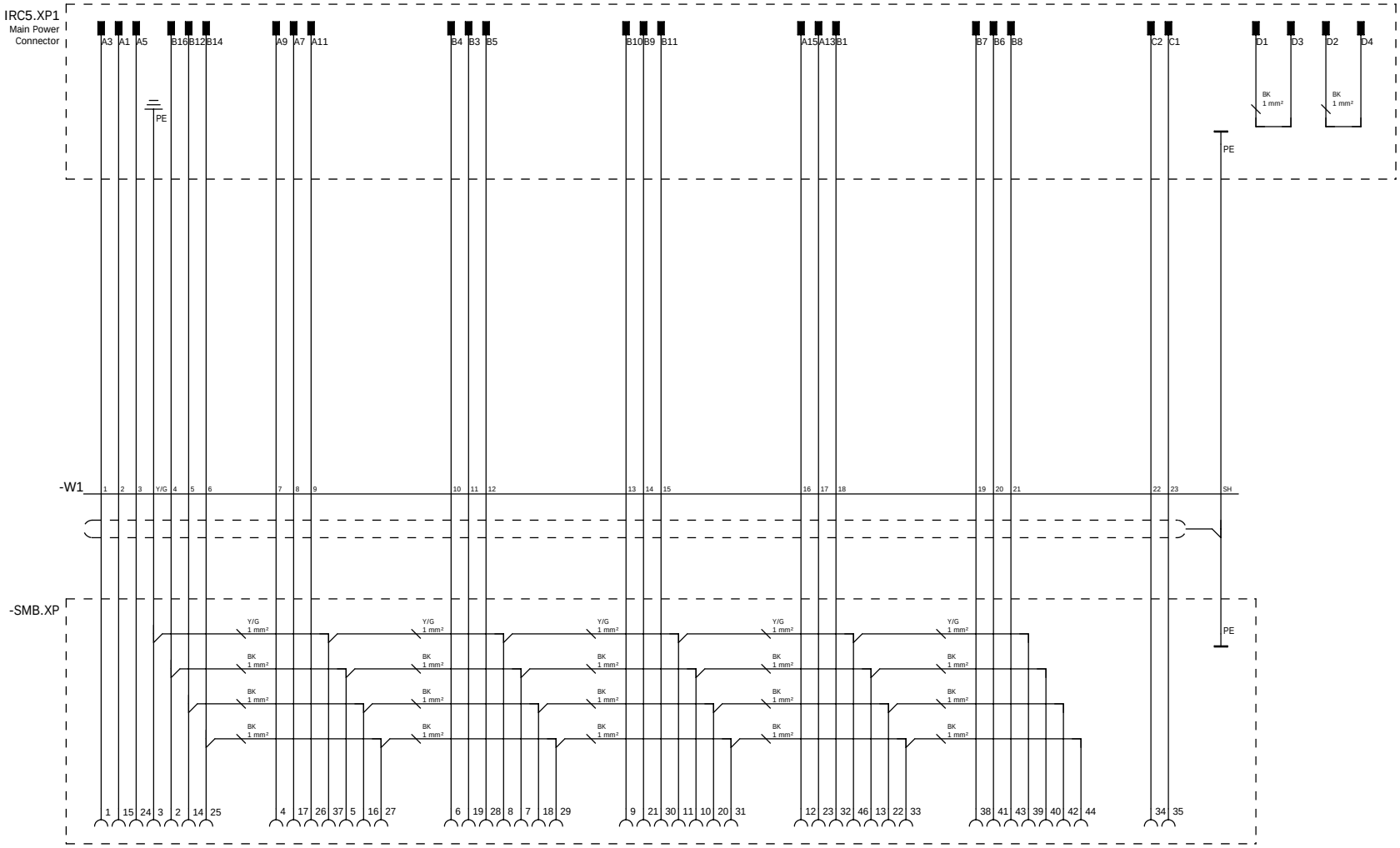
SAP NUMBER	Length
3HAW050008616-005	5M
3HAW050008616-010	10M
3HAW050008616-015	15M
3HAW050008616-020	20M
3HAW050008616-025	25M





	6 MotorPower StaticCable LowVoltage IRC5.XP1 to SMB.XP 64D 24B to 46EE 24B 500V		Layout	Status: Approved	=
Respsonsible Department: RS / BIW				Document no. 3HAW050008616-XXX	Rev.Ind 003
Prepare by, Date N,Cao 2014/8/25	Approve by,Date	Replacement of	Replaced by		Page 2 / Total Page 8

IRC5 Cabinet
Low Voltage
XP1/XS1



SMB BOX
Main Power
SMB.MP

	6 MotorPower StaticCable LowVoltage IRC5.XP1 to SMB.XP 64D 24B to 46EE 24B 500V		Connection	Status: Approved	=
Respsonsible Department: RS / BIW				Document no. 3HAW050008616-XXX	Rev.Ind 003
Prepare by, Date N,Cao 2014/8/25	Approve by,Date	Replacement of	Replaced by		Page 3 / Total Page 8

Cable diagram

F09_002_ABB

Cable name =+-W1			cable type Helukabel.83759					
function text			no. of conductors 25G			cross-section 1.5mm		Length
function text	Page / column	Target designation from	Connection point	conductor	Target designation to	Connection point	Page / column	function text
V1	/3.1	-IRC5.XP1	A3	1	-SMB.XP	1	/3.1	U1
U1	/3.1	-IRC5.XP1	A1	2	-SMB.XP	15	/3.1	V1
W1	/3.1	-IRC5.XP1	A5	3	-SMB.XP	24	/3.1	W1
24V PB	/3.1	-IRC5.XP1	B16	4	-SMB.XP	2	/3.1	24V PB1
24V Rel	/3.1	-IRC5.XP1	B12	5	-SMB.XP	14	/3.1	24V REL1
0V BK	/3.1	-IRC5.XP1	B14	6	-SMB.XP	25	/3.1	0V BK1
V2	/3.2	-IRC5.XP1	A9	7	-SMB.XP	4	/3.2	U2
U2	/3.2	-IRC5.XP1	A7	8	-SMB.XP	17	/3.2	V2
W2	/3.2	-IRC5.XP1	A11	9	-SMB.XP	26	/3.2	W2
V3	/3.3	-IRC5.XP1	B4	10	-SMB.XP	6	/3.3	U3
U3	/3.3	-IRC5.XP1	B3	11	-SMB.XP	19	/3.3	V3
W3	/3.3	-IRC5.XP1	B5	12	-SMB.XP	28	/3.3	W3
V4	/3.4	-IRC5.XP1	B10	13	-SMB.XP	9	/3.4	U4
U4	/3.4	-IRC5.XP1	B9	14	-SMB.XP	21	/3.4	V4
W4	/3.4	-IRC5.XP1	B11	15	-SMB.XP	30	/3.4	W4
V5	/3.5	-IRC5.XP1	A15	16	-SMB.XP	12	/3.5	U5
U5	/3.5	-IRC5.XP1	A13	17	-SMB.XP	23	/3.5	V5
W5	/3.5	-IRC5.XP1	B1	18	-SMB.XP	32	/3.5	W5
V6	/3.6	-IRC5.XP1	B7	19	-SMB.XP	38	/3.6	U6
U6	/3.6	-IRC5.XP1	B6	20	-SMB.XP	41	/3.6	V6
W6	/3.6	-IRC5.XP1	B8	21	-SMB.XP	43	/3.6	W6
PTC	/3.7	-IRC5.XP1	C2	22	-SMB.XP	34	/3.7	PTC
0V PTC	/3.7	-IRC5.XP1	C1	23	-SMB.XP	35	/3.7	0V PTC
	/3.7	-IRC5.XP1	PE	SH	-SMB.XP	PE	/3.7	
	/3.1	-IRC5.XP1	PE	Y/G	-SMB.XP	3	/3.1	PE1

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3HAW050008850 Rev J, en