Operating Manual
MHM-97874 , Rev 5.06
February 2024

Machinery Health™ System

A6500-TP Temperature Process Card

EMERSON™

Vermerk zur Installation der Messketten in explosionsgefährdeter Umgebung.

Soll die Messkette in explosionsgefährdeter Umgebung installiert werden, so ist auf die Einhaltung der in der Gebrauchsanwesisung enthaltenen Installationshinweise zu achten. Sollten dabei sprachliche Schwierigkeiten auftreten, wenden Sie sich bitte an die Herstellerfirma, sie wird Ihnen eine Übersetzung der relevanten Artikel in der Landessprache des Verwendungslandes zukommen lassen.

Nota fuq l–installazzjoni tal–ktajjen tal–kejl f'ambjent esplożiv

Jekk il–katina tal–kejl suppost li tigi installata f'ambjent esplożiv, hu importanti li ssegwi l–istruzzjonijiet pertinenti tal–manwal.Jekk issib xi diffikultà bil–lingwa, jekk joghgbok ikkuntattja lill–manifattur biex tikseb traduzz-joni tal –paragrafi rilevanti fil–lingwa mehtiega.

Anmärkning beträffande installation av mätkedjorna i explosionsfarlig miljö.

Ska mätkedjan installeras i explosionsfarlig miljö, måste de anvisningar följas som ges i instruktionsboken beträffande installationen. Skulle därvid språkproblem uppstå, ber vi dig kontakta det tillverkande företaget som då kommer att sända dig en översättning av de relevanta artiklarna på användningslandets språk.

Opomba za namestitev merilne verige v eksplozivno ogroženem okolju

Èe se merilna veriga namešèa v eksplozivno ogroženem okolju, je potrebno upoštevati namestitvena opozorila, ki so v Navodilih za uporabo. Èe se pri tem pojavijo jezikovne težave, se posvetujte z izdelovalcem; poslali vam bodo prevod ustreznih èlankov v jeziku države, kjer se naprava uporablja.

Záznam k inštalácii meracích reťazcov vo výbušnom prostredí

Ak má byť merací reťazec inštalovaný vo výbušnom prostredí, treba dbať na dodržiavanie pokynov k inštalácii, uvedených v návode na použitie. V prípade, že by sa pritom vyskytli jazykové problémy, obráťte sa prosím na výrobcu, ktorý Vám zašle preklad relevantných èlánkov v jazyku Vašej krajiny.

Nota referente à instalação de cadeias de agrimensor em ambientes potencialmente explosivos

Caso a cadeia de agrimensor deva ser instalada em um ambiente potencialmente explosivo, é imprescindível observar e cumprir as indicações de instalação das instruções de serviço. Caso tenha dificuldades idiomáticas, queira entrar em contato com a firma produtora, esta poderá enviar–lhe uma tradução dos capítulos mais importantes no idioma do país onde o produto deverá ser empregado.

Wskazówka dotycząca instalacji łańcuchów mierniczych w otoczeniach zagrożonych eksplozją.

Jeżeli łańcuch mierniczy ma być zainstalowany w otoczeniu zagrożonym eksplozją, należy uwzględnić wskazówki dotyczące instalacji, które są zawarte w instrukcji obsługi. Jeżeli w trakcie lektury wystąpią jakiekolwiek problemy związane ze zrozumieniem tekstu, prosimy zwrócić się do producenta, który chętnie wykona tłumaczenie wybranych części dokumentacji na język danego kraju.

Opmerking m.b.t. installatie van elektrische meet circuits in explosiegevaarlijke omgeving

Dient de installatie van elektrische meet circuits in een explosiegevaarlijke omgeving te geschieden, moet men toezien dat de in de gebruikshandleiding opgenomen installatieinstructies worden nageleefd. Bij taalkundige problemen gelieve contact op te nemen met de fabrikant, deze zal u vervolgens een vertaling in de taal van het gebruiksland doen toekomen.

Pastaba dėl matavimo grandinės įrengimo sprogimo atžvilgiu pavojingoje aplinkoje

Jei matavimo grandinė turi būti įrengta sprogimo atžvilgiu pavojingoje aplinkoje, privaloma laikytis vartotojo instrukcijoje pateiktų įrengimo nurodymų. Jei kiltų sunkumų dėl kalbos, prašome kreiptis į gamintojo įmonę, kuri pateiks Jums reikiamo skyriaus vertimą į vartotojo valstybės kalbą.

Nota sull'installazione delle catene per misurazione in ambienti a rischio di esplosioni

Nel caso in cui si debbano installare le catene per misurazione in ambienti a rischio di esplosioni, è necessario attenersi alle avvertenze per l'installazione contenute nelle istruzioni d'uso. Per difficoltà di carattere linguistico, rivolgetevi alla ditta produttrice. Quest'ultima Vi farà pervenire una traduzione degli articoli rilevanti nella lingua del paese d'impiego.

Megjegyzés a mérőláncok robbanásveszélyes környezetben történő szereléséhez.

Ha a mérőláncot robbanásveszélyes környezetben kell felszerelni, akkor ügyeljen a Használati útmutatóban közölt szerelési utasítások betartására. Amennyiben nyelvi nehézségek merülnek fel, szíveskedjen a gyártó céghez fordulni, amely elküldi Önnek a felhasználó ország nyelvére lefordított, erre vonatkozó cikket.

Remarque concernant l'installation des chaînes de mesure dans un environnement présentant un risque d'explosion

Si la chaîne de mesure doit être installée dans un environnement présentant un risque d'explosion, il est impératif de veiller à respecter les consignes d'installation contenues dans les instructions de service. S'il devait ce faisant surgir des problèmes linguistiques, veuillez vous adresser à la société fabricante: elle vous fera parvenir une traduction des articles significatifs dans la langue du pays de mise en oeuvre.

Huomautus mittausketjun asentamisesta räjähdysalttiissa ympäristössä

Jos mittausketju tulee asentaa räjähdysalttiissa ympäristössä, on käyttöohjeessa annettuja asennusohjeita noudatettava. Jos käyttöohjeessa käytetty kieli aiheuttaa ongelmia, kääntykää valmistajayrityksen puoleen. Se toimittaa käyttöönne tarvittavat artikkelit käyttömaan vir alliselle kielelle käännettynä.

Juhend mõõdukettide ülespanemiseks plahvatusohtlikus piirkonnas.

Kui panna üles mõõdukettid plahvatusohtlikkus piirkonnas, nii tuleb jälgida kasutusjuhendis sisaldatud instalationimärkmeid. Juhul kui tekkivad raskused keelega, siis pöörduge palun tootja poole. Tootja saadab emakeelse tõlge vastavalt artiklile ning maale.

Notas sobre la instalación de cadenas de medición en un entorno potencialmente explosivo.

Si ha de instalar la cadena de medición en un entorno potencialmente explosivo, deberá respetar las indicaciones sobre la instalación, contenidas en el manual de uso. Si surgieran dificultades lingüísticas, póngase en contacto con la empresa fabricante, que le facilitará una traducción del artículo en la lengua del país donde se emplee.

Note on the installation of the measuring chains in an explosive environment

If the measuring chain is supposed to be installed in an explosive environment, it is important to follow the pertinent installation instructions in the manual. Should you encounter difficulties with the language, please contact the manufacturer to obtain a translation of the relevant paragraphs into the language required.

Σημείωση για την εγκατάσταση αλυσίδωυ μέτρησης σε περιβάλλου, στο οποίο υπàρΧει κίυδυυος έκρηξης

Εάυ η αλυσυδα μέτρησης πρόκειται υα εγκατασταΘεί σε περιβάλλου, στο οποίο υπάρΧει κίυδυυος έκρηξης, πρέπει υα τηρηΘούυ οπωσδήποτε οι οδηγίες εγκατάστασης που περιλαμβάυουται στις οδηγίες Χρήσης. Εάυ υπάρξουυ γλωσσικές δυσκολίες καταυόησης, παρακαλούμε υα απευΘυυΘείτε στηυ κατασκευάστρια εταιρεία, η οποία Θα φρουτίσει για την αποστολή μιας μετάφρασης τωυ σΧετικωυ άρΘρωυ στη γλωσσα της Χωρας Χρήσης.

Info vedrørende installation af målekæderne i eksplosionstruede omgivelser

Hvis målekæden skal installeres i eksplosionstruede omgivelser, skal installationsanvisningerne i brugsanvisningen følges. Hvis der i denne forbindelse opstår sproglige problemer, bedes De henvende Dem til produktionsfirmaet, som så vil sørge for, at De modtager en oversættelse af den relevante artikel på Deres sprog.

Poznámka k instalaci měřicích řetězců v prostředí s nebezpečím výbuchu.

Když má být měřicí řetězec (sestávající z čidla a konvertoru) instalován v prostředí s nebezpečím výbuchu, tak je třeba respektovat instalační pokyny, které jsou součástí návodu k upotřebení. Kdyby při tom došlo k jazykovým potížím, tak prosíme kontaktujte výrobní firmu, která Vám relevantní článek zašle v jazyku krajiny použití.

Piezīme par mērīšanas ķēžu instalēšanu sprādziena bīstamās zonās.

Ja mērīšanas ķēde jāuzstāda sprādzienbīstamā zonâ, ir jāievēro lietošanas instrukcijā dotie instalēšanas norādījumi. Ja rodas kādas valodas grūtības, lūdzu griezieties pie izgatavotāja firmas, kas Jums nosūtīs nozīmīgâko nodaļu tulkojumus lietotāja valsts valodā.

Emerson
epro GmbH
Jöbkesweg 3
48599 Gronau
Germany
T +49 2562 709 0
F +49 2562 709 401
www.Emerson.com

Contents

1 General

1.1 Using this manual

This manual contains information concerning the use of the device.

Read the operating manual completely prior to starting installation and operating the device. Comply with all safety instructions.

This operating manual applies for A6500-TP Temperature Process Cards with hardware revisions and software versions listed in Table 1-1.

Table 1-1: Hardware and software revisions

Hardware revision	Firmware version	AMS Machine Studio version
03, 04, 05, 06, 07, and 08[1]	3.x [2]	3.x

1 *See type plate for revision level.*
2 *Requires an A6500-CC with firmware version 3.x.*

Include the operating manual when transferring the device to third parties.

Note
When requesting technical support, please indicate type and serial number from the type plate.

Table 1 shows a list of documents that are referred to in this operating manual.

Table 1-2: Referenced documents

MHM-97875	Operating Manual A6500-CC Com Card
MHM-97877	Operating Manual A6500-xR System Racks
MHM-97879	Operating Manual AMS Machine Studio - General Functions

1.2 Symbols

Note
This symbol marks passages that contain important information.

⚠ CAUTION

This symbol marks operations that can lead to malfunctions or faulty measurements, but will not damage the device.

⚠ DANGER

A danger indicates actions that can lead to property damage or personal injury.

	According to IEC 61010, this symbol means that this device must be operated with DC voltage.

	According to IEC 61010, this symbol means that the documentation of the device must completely be read and understood before installing and commissioning of the device. Observe all safety related instructions in this document.

1.3 Liability and guarantee

Emerson is not liable for damages that occur due to improper use. Proper use also includes the knowledge of, and compliance with, this document.

Customer changes to the device that have not been expressly approved by Emerson will result in the loss of guarantee.

Due to continuous research and further development, Emerson reserves the right to change technical specifications without notice.

1.4 Incoming goods inspection

Check the content of the shipment to ensure that it is complete; visibly inspect the goods to determine if the device has been damaged during transport. The following parts are included in the scope of delivery and must be contained in the shipment.

- A6500-TP Temperature Process Card
- Operating manual

If the contents are incomplete, or if you observe any defects, file a complaint with the carrier immediately. Inform the responsible Emerson sales organization so your device can be replaced. In this case, attach a tag with customer name and the observed defect.

1.5 Technical support

You may need to ship this product for return, replacement, or repair to an Emerson Product Service Center. Before shipping this product, contact Emerson Product Support to obtain a Return Materials Authorization (RMA) number and receive additional instructions.

Product Support

Emerson provides a variety of ways to reach your Product Support team to get the answers you need when you need them:

Phone	Toll free 1 800 833 8314 (U.S. and Canada) +1 512 832 3774 (Latin America) +63 2 8702 1111 (Asia Pacific, Europe, and Middle East)
Email	Guardian.GSC@Emerson.com
Web	http://www.emerson.com/en-us/contact-us

To search for documentation, visit http://www.emerson.com.

To view toll free numbers for specific countries, visit http://www.emerson.com/technicalsupport.

Note
If the equipment has been exposed to a hazardous substance, a Material Safety Data Sheet (MSDS) must be included with the returned materials. An MSDS is required by law to be available to people exposed to specific hazardous substances.

1.6 Storage and transport

Store and transport the device only in its original packaging. Technical data specifies the environmental conditions for storage and transport.

Related information

Technical data
Power supply
Signal input
Digital input
Outputs
Data interface
Mechanical design and environmental conditions

1.7 Disposal of the device

Provided that no repurchase or disposal agreement exists, recycle the following components at appropriate facilities:

- Recyclable metal
- Plastic elements

Sort the remaining components for disposal, based on their condition. National laws or provisions on waste disposal and protection of the environment apply.

Note
Environmental hazards! Electrical waste and electronic components are subject to treatment as special waste and may only be disposed by approved specialized companies.

1.8 China RoHS Compliance

Our products manufactured later than June 30, 2016, and those which are sold in the People's Republic of China are marked with one of the following two logos to indicate the Environmental Friendly Use Period in which it can be used safely under normal operating conditions.

Products that do not have the following marking were either manufactured before June 30, 2026, or are not electrical equipment products (EEP).

Circling arrow symbol with "e": The product contains no hazardous substances over the Maximum Concentration Value and it has an indefinite Environmental Friendly Use Period.

Circling arrow symbol with a number: This product contains certain hazardous substances over the Maximum Concentration Value and it can be used safely under normal operating conditions for the number of years indicated in the symbol. The names and contents of hazardous substances can be found in chapter "Certificates".

1.9 CCC Certification – AMS 6500 ATG

With the announcement of the Chinese market regulation authority SAMR (State Administration for Market Regulation), a Compulsory Product Certification (CCC certification) is mandatory for many explosion protection products. This explosion proof (“Ex”) product complies to the CCC obligation and is certified (certification number: 2020322304002386).

This China Compulsory Certificate mark (CCC), is a compulsory safety mark for many products imported, sold, or used in the Chinese market and indicates that the product is certified in accordance to GB/T 3836.1-2021, GB/T 3836.3-2021, and GB/T 3836.8-2021. If the product label is to small to contain the CCC certification mark, it is sufficient to have the mark printed on the minimum package and in the attached document.

1.10 Installation awareness

Note

When planning a measurement, follow these guidelines:

- Consider environmental conditions which might have an influence on the measurement such as temperature, humidity, substances aggressive to the sensor, and pollution.
- Always use a stiff and vibration-free sensor holder.
- Define a suitable measuring range, not larger than necessary, in consultation with the operator of the plant.
- Define the trip limit in consultation with the operator of the plant.
- Take measurement deviations into account when defining trip limits.
- Use a sensor that meets the requirements of the defined measuring range.
- Ensure an EMC-compatible installation including the use of proper cables.
- Ensure proper function of the measurement before activating the measurement in the production environment.

2 Safety instructions

To ensure safe operation, carefully follow all the instructions in this manual.

The correct and safe use of this device requires that operating and service personnel both understand and comply with general safety guidelines and observe the special safety comments listed in this manual. Where necessary, safety-sensitive points on the device are marked.

⚠ DANGER

Because the device is electrical equipment, only specially trained and authorized personnel may commission, service, and maintain this equipment.

2.1 Using the device

Install and use the device as specified in this document.

If the device is used in a manner not specified by the manufacturer, the functions and protection provided by the device may be impaired.

2.2 Owner's responsibility

If there is a reason to suspect that hazard-free operation, and thus, adequate machine protection is no longer possible, take the device out of operation and safeguard it from unintentional operation. This is the case:

- if the device shows visible damage.
- if the device no longer works.
- after any kind of overload that has exceeded the permissible limits (see technical data of the device for permissible limits).

⚠ DANGER

If device tests have to be completed during operation or if the device has to be replaced or decommissioned, it will impair the machine protection and may cause the machine to shut down. Make sure to deactivate machine protection before starting such work, and reactivate it after work has been completed.

Related information

Technical data
Power supply
Signal input
Digital input
Outputs
Data interface
Mechanical design and environmental conditions

2.3 Radio interference

The device is carefully shielded and tested to be technically immune to radio interference and complies with current standards. However, if you operate this device together with other peripheral devices that are not properly shielded against radio interference, disturbances and radio interferences may occur.

2.4 ESD safety

⚠ DANGER

Internal components can be damaged or destroyed due to electrostatic discharge (ESD) during the handling of the device.

Take suitable precautions before handling the device to prevent electrostatic discharges through the electronics. Such measures might include, for example, wearing an ESD bracelet. Transport and storage of electronic components may only be made in ESD-safe packaging.

Handle the device with particular care during dry meteorological conditions with relative humidity below 30% as electrostatic discharges can occur more frequently.

3 Application and design

3.1 Application

The A6500-TP Temperature Process Card is a component of the AMS 6500 ATG Machine Protection System. The card is equipped with four measuring channels for temperature measurements with thermocouples or resistance temperature detectors (RTDs) and for measurements of process signals 0 - 1 V, 0 - 10 V, or 0/4 - 20 mA standard signals. Also, the card contains 2 digital inputs and 6 digital outputs.

The measured signals are transmitted via the internal RS 485 bus to the A6500-CC Com Card and converted to Modbus RTU, Modbus TCP/IP and OPC UA protocols for further transmission to host computers or analysis systems. In addition, the Com Card provides the communication via the USB socket at the face plate for the connection to PC/laptop for the configuration of protection cards and for visualization of measuring results.

The measuring results can be output via analog outputs 0/4 - 20 mA. These outputs have a common ground and are electrically isolated from the system supply.

The operation of the A6500-TP Temperature Process Card is performed in the A6500-xR System Racks, which also provides connection of supply voltages and signals.

The A6500-TP Temperature Process Card provides the following functions:

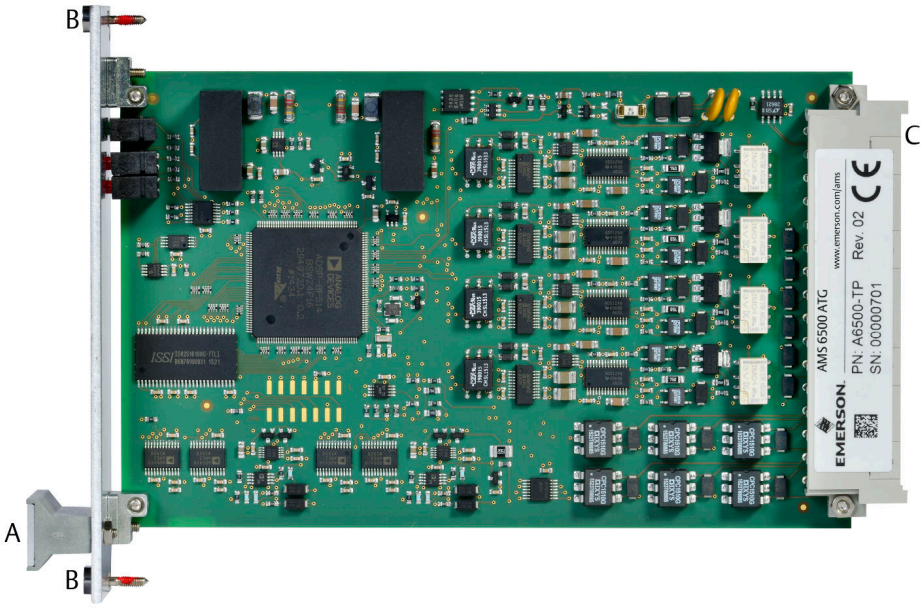
- Temperature measurement with resistance temperature detectors (RTDs)
- Temperature measurement with thermocouples with internal and external cold junction compensation
- Measurement of standard process signals 0 - 1 V, 0 - 10 V, or 0/4 - 20 mA
- Acquisition of digital signals with two digital inputs
- Output of analog values for each measuring channel via 4 current outputs 0/4 - 20 mA
- Output of alarms via 6 digital outputs; the assignment to the measuring channels can be configured in any way

3.2 Design

The A6500-TP Temperature Process Card is designed as a standard euro board (100 mm x 160 mm) and has an anodized front plate of 6 HP (approximately 30 mm) width.

Monitors of the AMS 6500 ATG system may be installed in any operating position in standard module frames 19", 3RU height, or any other Intermas compatible systems and housings. This manual describes installation and operation of the A6500-TP Temperature Process Card in the A6500-xR System Racks. Figure 3-1 shows the side view of the card.

Figure 3-1: Side view



A. Handle - for pulling the monitor from the rack; labeled with the serial number on a small sticker.
B. Mounting screws
C. Connector with type plate with designation (PN), serial number (SN), and hardware revision (Rev.).

Figure 3-2 shows the front plate elements.

Figure 3-2: Front view

A. Handle
B. Mounting screws
C. green LED: Card status indication
D. red LEDs: Alarm status

4 Installation

For installation and mounting of the A6500-xR System Racks, sensor connection, and wiring, see operation manual of the A6500-xR System Racks.

Procedure

1. Select one of the eleven protection card slots 1 to 11.
2. Wire the slot in accordance to the measuring task (sensor connection, digital inputs and outputs, and so on).
3. Push the card into the prepared slot.
4. Secure the card by gently fastening the screws at the front plate.

Note
The AMS 6500-ATG cards are hot-swappable. So, it is not necessary to switch off the power supply of the system rack for installing or replacing cards.

⚠ CAUTION

Any work at the system may impair machine protection.

4.1 Commissioning

Procedure

1. If the card is not configured, create a configuration with AMS Machine Studio, download it to the card (see Configuration).
2. Ensure proper measurement by checking input and output signals (see Functional check).

4.2 CSA - General safety

Conditions of acceptability

See chapter "CSA - General safety" of the A6500-xR System Racks operating manual (MHM-97877) for conditions of acceptability.

5 Hazardous location installation

The ex-approval of the A6500-TP Temperature Process Card is only valid if the Temperature Process Card is installed in A6500-xR System Racks. See chapter "Hazardous location installation" of the A6500-xR System Racks operating manual (MHM-97877) for details.

6 Configuration

6.1 General configuration procedure

The configuration can be performed offline, without connection to the card or online, with a connection to the card. In any case, the configuration has to be loaded into the card. The A6500-CC Com Card is required for the configuration procedure. See Com Card operating manual for details.

Prerequisites

- A6500-CC Com Card
- USB cable with Type-A and Type-B plug or Ethernet cable
- AMS Machine Studio (configuration software)
- PC or laptop with Microsoft Windows 10

6.1.1 Offline configuration overview

Procedure

1. Start AMS Machine Studio.
2. Enter configuration parameter according to the measuring task.
3. Save the configuration.
   When there is a connection to the system, you can load the saved configuration file to the card (see Send a saved configuration file to the card).

Send a saved configuration file to the card

Procedure

1. Switch on the power supply of the system if not already on.
2. Connect the laptop to the communication card of the system by using the USB or Ethernet connection.
3. Start AMS Machine Studio.
4. Select the card to be configured and click **Configure**.
5. Open the saved configuration file (**File** → **Open**).
6. Send the configuration to the card.
7. Close AMS Machine Studio and disconnect the connection to the communication card.
   After these steps, the Temperature Process Card is ready for operation.

6.1.2 Online configuration overview

Procedure

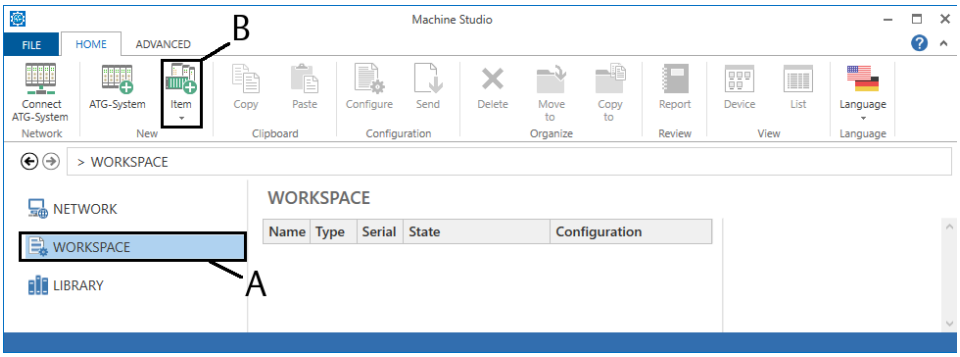
1. Switch on the power supply of the system if not already done.
2. Connect the laptop to the communication card of the system by using the UBS or Ethernet connection.
3. Start AMS Machine Studio.
4. Select the card to be configured and click **Configure**.
5. Enter the configuration parameters according to the measuring task.
6. Send the configuration to the card.
7. Save the configuration.
8. Close the AMS Machine Studio and disconnect the connection to the communication card.
   After these steps, the Temperature Process Card is ready for operation.

6.2 Start of an offline card configuration

Procedure

1. Select **Workspace** in the left part of the **Home** view then click Item (see Figure 6-1).

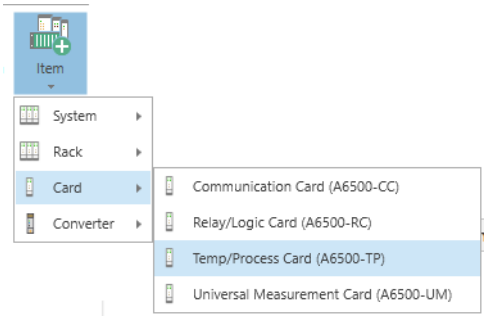
Figure 6-1: Start new device configuration



A. Workspace
*B. Button **Item***

2. Select **Temp/Process Card (A6500-TP)** from the device list (see).

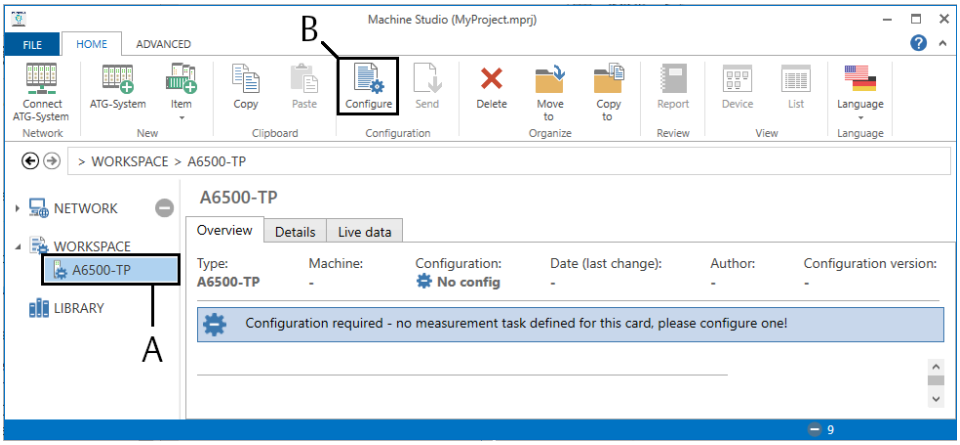
Figure 6-2: Device selection



The Temperature Process Card is added to the list below **Workspace**.

3. Select **A6500-TP** from the device list and click **Configure**.

Figure 6-3: Open editor



A. New Temperature Process Card
*B. Button **Configure** to open the configuration editor*

The **New configuration** dialog opens.

4. Click **Create configuration** to open the configuration editor.

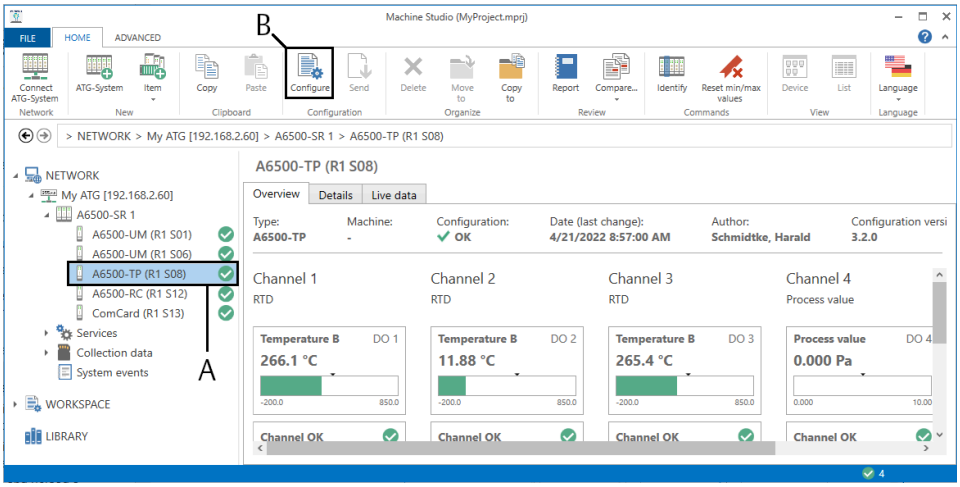
   See Configuration editor and parameters for parameter description and settings.

6.3 Start of an online card configuration

Procedure

1. Select the A6500-TP card to be configured from the **Network** list in the left part of the **Home** view, then click **Configure** (see).

Figure 6-4: Select a Temperature Process Card for online configuration



A. Selected A6500-TP card
*B. Button **Configure** for opening the configuration editor*

The **New configuration** dialog opens if an unconfigured card has been selected, otherwise the configuration editor opens (continue with Step 3).

2. Click **Create configuration** to open the configuration editor.
3. Check the configuration and modify it in accordance to the measuring task. See Configuration editor and parameters for parameter description and settings.

6.4 Configuration of an already existing card

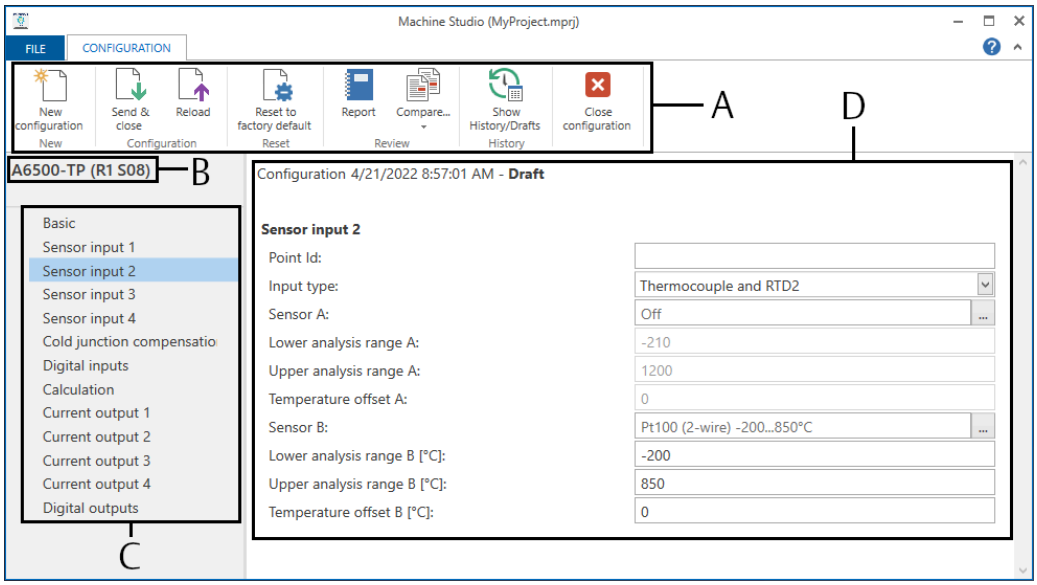
Procedure

1. Select the card to be reconfigured from the **Network** list.
2. Click **Configure** to open the configuration window.
3. Make the changes to the configuration.
4. Send the configuration to the card (see Send a configuration).

6.5 Configuration editor and parameters

Figure 6-5 shows an overview of the general configuration editor.

Figure 6-5: Configuration editor



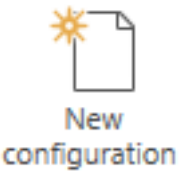
A. Ribbon command bar
B. Card name and position within the rack (only visible at connected racks, for example: R1 = Rack 1; S08 = Slot 8)
C. List of configuration pages
D. Configuration page

6.5.1 Ribbon command bar

The ribbon command bar of **Configuration** shows the icons for the file handling:

New configuration

Figure 6-6: Button "New configuration"



Click **New configuration** to create a new configuration with default parameters.

Send & close

Figure 6-7: Button "Send & close"

Click **Send & close** to send the configuration to the Temperature Process Card. The configuration editor automatically closes after the sending process. This command requires an online connection to the card. See Send a configuration.

⚠ CAUTION

The machine protection function of the card is disabled during sending of configurations with major changes because of a reboot of the A6500-TP Card.

Reload

Figure 6-8: Button "Reload"

Click **Reload** to reload the configuration from the Temperature Process Card to the configuration editor.

Reset to factory default

Figure 6-9: Button "Reset to factory default"

Click **Reset to factory default** to reset the connected Temperature Process Card to the default parameter settings. After a successful reset the OK LED is flashing. Now the card is in the delivery state again. A reset card is marked with the "No configuration" sign in the Online View (see Figure 6-10).

Figure 6-10: No configuration sign

This command requires an online connection to the card.

⚠ CAUTION

The present configuration on the card will be deleted and replaced by the default configuration.

Compare

Figure 6-11: Button "Compare"

Click **Compare** to show differences between the configuration on the card and in the memory of the used Laptop or PC.

Report

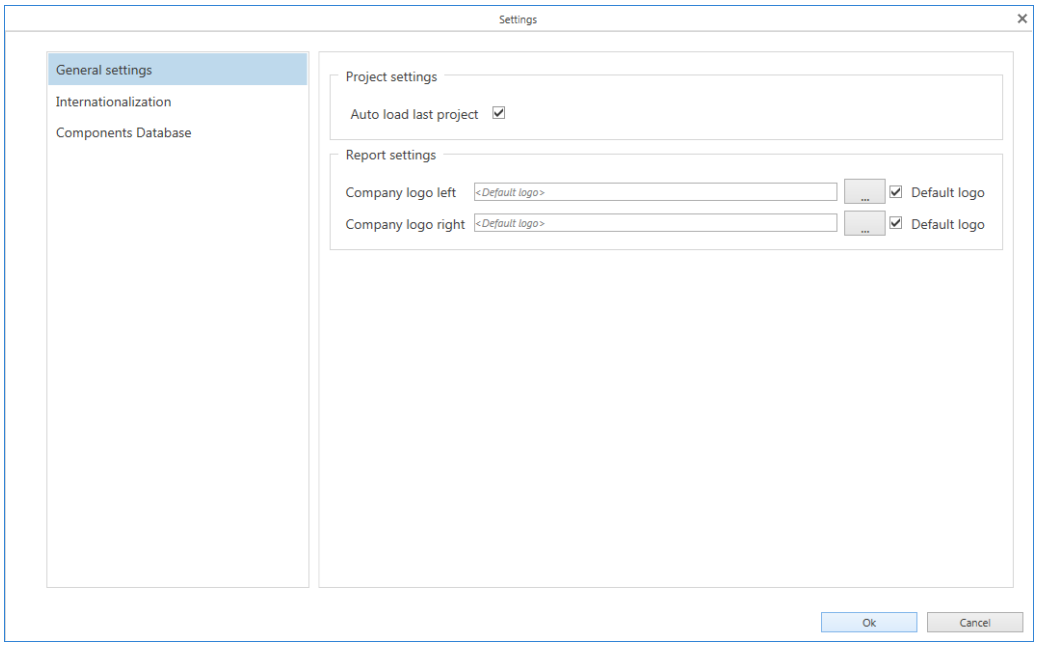
Figure 6-12: Button "Report"

Click **Report** to open the report viewer. This report shows all configured parameters and some additional information as, for example, serial number and user information. This report can be exported to different formats such as PDF, XPS, and Microsoft Excel or printed.

The logos in the header of the report can be changed.

1. Close the configuration editor.
2. Click tab **File** and then **Settings**.
   The window **Settings** opens (see Figure 6-13)
3. Click the buttons with the dotted line within the **Report settings** area to browse for logos.
   Logos with file format "png" or "jpg" can be selected.
4. Click **OK** to confirm your settings.
   The window closes.
5. Open the configuration editor and go back to the report.
   Now the report contains the selected logos.

Figure 6-13: General settings

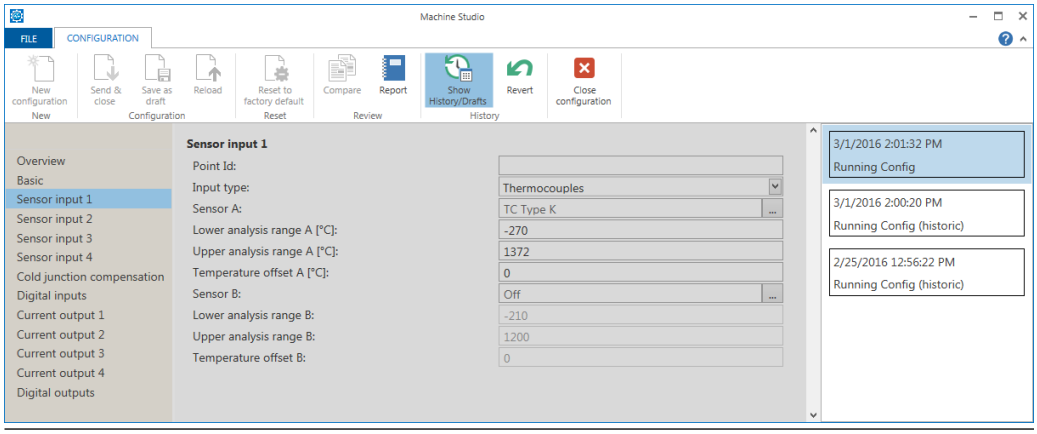


Show History/Drafts

Figure 6-14: Button "Show History/Drafts"

Click **Show History/Drafts** to open the History (see Figure 6-15).

Figure 6-15: History



The right part of Figure 6-15 shows the configuration history. The individual files are marked with date and time and type:

- **Draft Config**
  A saved preliminary configuration file which has not yet send onto the card.
- **Running Config**
  This configuration file is running on the connected card.
- **Running Config (historic)**
  An old configuration file which was running in the past.

The editor area is grayed out. You can see the parameters of the historic files but you can not change them. Parameters can be only changed in the editor. Copying a historic configuration to the editor:

- Select a draft or historic file from the right list of the window by a left mouse click. The parameter of the selected file are displayed in the grayed out editor area.
- Click **Revert** (see Figure 6-16). The selected file is copied to the editor and the history window closes. Click **Show History/Drafts** again, if you want to leave the history without any file copying.

Figure 6-16: Button "Revert"

Close configuration

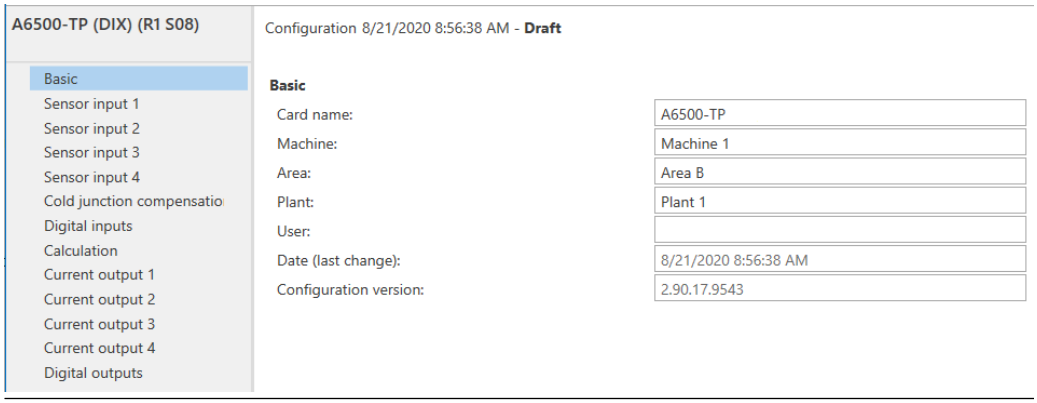
Figure 6-17: Button "Close configuration"

Click **Close configuration** to leave the editor. Changes are automatically saved as a draft configuration. A saved draft can be opened in the history view.

6.5.2 Basic

Basic information about the system, the machine, where the system is installed, and the location where the system rack with this card is installed is managed using this menu. The menu also indicates the name of the user who made the last changes of configurations along with date and time of the last changes. See Figure 6-18.

Figure 6-18: Basic



Card name	Designation for card type.
Machine	Designation for the machine where this system is installed.
Area	Area in plant or factory where the system is installed.
Plant	Designation for the location where the system is implemented.
User	The entry shows the name of the user who has made the last changes to this configuration. The user name of the login data of the operation system is used for this automatic entry. It is not possible to change the content of this field.
Date (last change)	Date and time of the last changes to this configuration. Time and date of the configuration PC is used. It is not possible to change the content of this field.
Configuration version	The version of AMS Machine Studio used to configure the card is displayed.

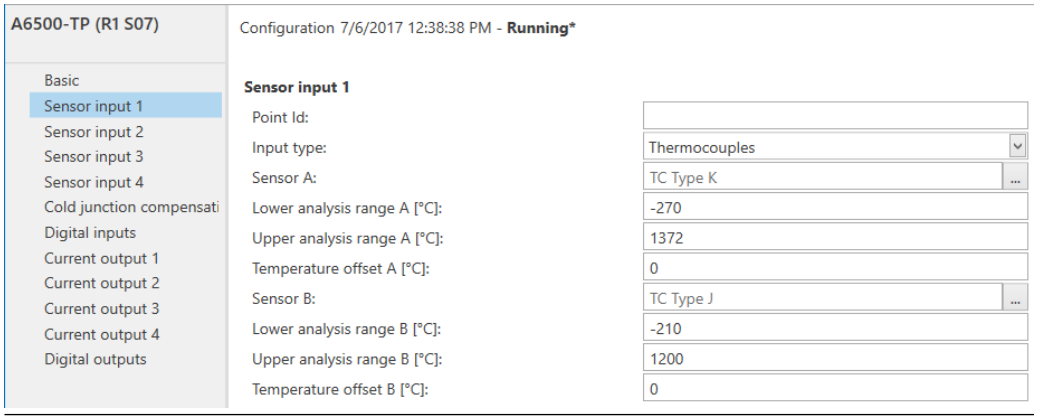
6.5.3 Sensor input

The sensor input configuration contains a list with two parameter subgroups "Sensor A" and "Sensor B" to define measuring function, sensor type, measuring range, and sensor offset. See Figure 6-19.

Two subgroups A and B are only possible for thermocouple measurement and for a thermocouple in combination with an RTD.

If function process input or RTD has been selected, the program offers only one subgroup B for configuration.

Figure 6-19: Sensor input



Point ID Enter here the description for the measuring point at the machine.

Input type Select a measuring function from the **Input type** menu.

- **Thermocouple**
  Temperature measurement with thermocouple.
- **Thermocouple and RTD2**
  Temperature measurement with thermocouple and measurement of cold junction temperature with RTD.
- **RTD**
  Temperature measurement with RTD.
- **Process value**
  Measurement of process values 0 - 1 V, 0 - 10 V, or 0 - 20 mA / 4 - 20 mA.
- **No function (Off)**
  No measuring function for this channel.

⚠ CAUTION

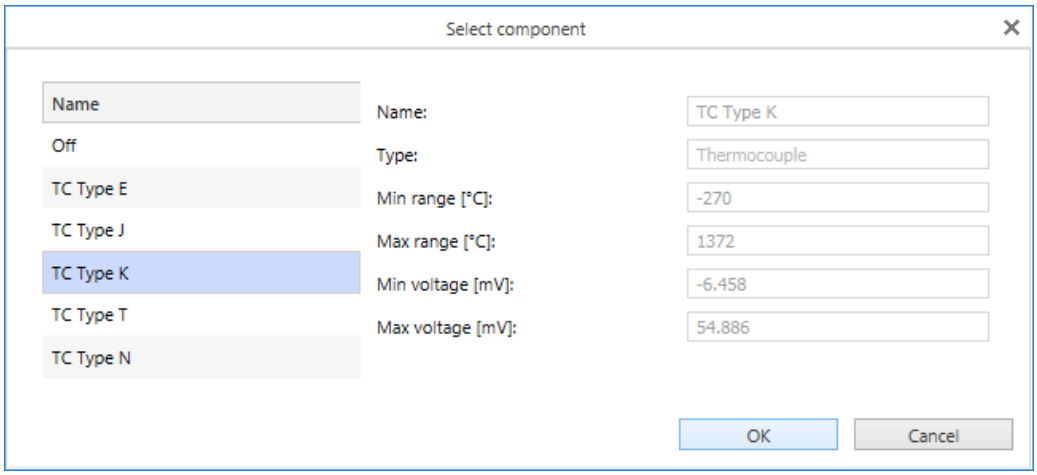
Because of the high sensitivity of the sensor inputs, signals can be detected even at open inputs. To avoid an unintentional behavior of the card, deactivate unused input channels – select **No function (Off)**.

Temperature measurement with thermocouples

Select measuring function **Thermocouples** by clicking on this line in field **Input type**.

Click on the selection button ... right of line **Sensor A** to open submenu **Select component** (see Figure 6-20).

Figure 6-20: Selection menu thermocouple type



Click on the desired type description on the left side to select the type of thermocouple for your application. For information, the fields on the right side show the possible temperature range in fields **Min range** and **Max range**. The parameter fields on the right side of this menu are only for information purposes, these parameters cannot be changed.

- **Off**
  No sensor selected
- **Thermocouple type E**
  NiCr - CuNi: Nickel Chromium (Chromel) - Copper Nickel (Constantan)
- **Thermocouple type J**
  Fe - CuNi: Iron - Copper-Nickel (Constantan)
- **Thermocouple type K**
  NiCr - NiAl: Nickel Chromium (Chromel) - Nickel Aluminum
- **Thermocouple type T**
  Cu - CuNi: Copper - Copper-Nickel (Constantan)
- **Thermocouple type N**
  NiCrSi - NiSi: Nickel Chromium Silicon (Nicrosil) - Nickel Silicon (Nisil)

Click **OK** to confirm the selection. The program returns to menu **Configuration**.

Line **Sensor A** (sensor connected to sub channel A) of this menu shows the selected sensor type and in the fields below the parameters for measuring range and temperature offset:

Lower analysis range A [°C]	Enter the lower limit value for the analysis range.
Upper analysis range A [°C]	Enter the upper limit value for the analysis range.
Temperature offset A [°C]	Use this field if the temperature can not be measured directly and the temperature difference between the actual measurement point and the installation place of the

temperature sensor is known. Enter the temperature difference (offset). Permissible range -200 to +300°C.

When entering parameters into these fields, only digits and minus-signs are allowed. Figures without signs are assumed to be positive (see Figure 6-19).

In the same way you can enter parameters for the sensor connected to subchannel B.

Temperature measurement with thermocouple and RTD2

For this measuring function subchannel A is programmed for a thermocouple and subchannel B for a 2-pole RTD measurement function.

Select measuring function **Thermocouples and RTD2** by clicking on this line in field. Click on the selection button ... right of line **Sensor A** to open submenu **Select component**. See Figure 6-20.

Click on the desired type description on the left side to select the type of thermocouple for your application. For information, the fields on the right side show the possible temperature range in fields **Min range** and **Max range**. The parameter fields on the right side of this menu are only for information purposes, these parameters cannot be changed.

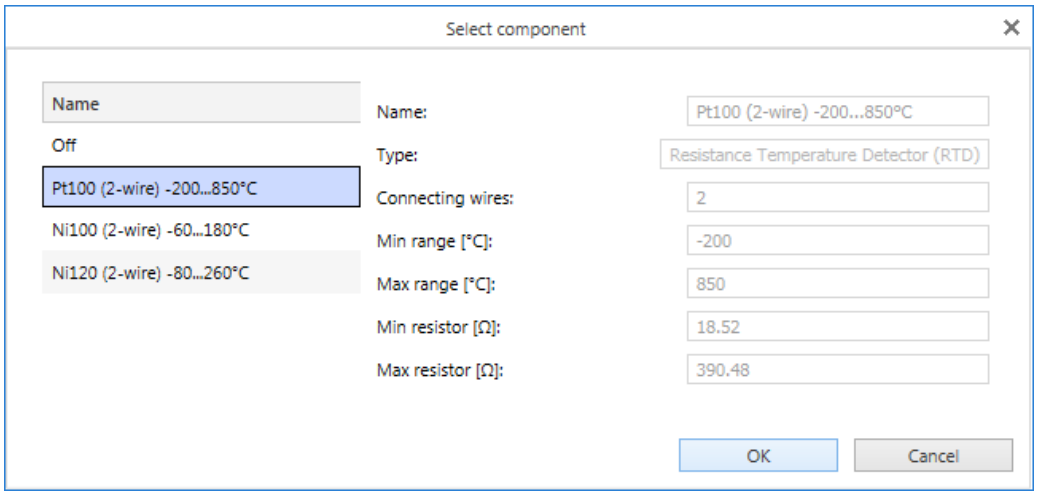
Click **OK** to confirm the selection. The program returns to menu **Configuration**.

Line **Sensor A** shows the selected sensor type and in the fields below the parameters for measuring range and temperature offset.

Lower analysis range A [°C]	Enter the lower limit value for the analysis range.
Upper analysis range A [°C]	Enter the upper limit value for the analysis range.
Temperature offset A [°C]	Use this field if the temperature can not be measured directly and the temperature difference between the actual measurement point and the installation place of the temperature sensor is known. Enter the temperature difference (offset). Permissible shift range -200 to +300°C.

To configure the measurement for the cold junction temperature click on the selection button ... right of line **Sensor B** to open submenu **Select component** (see Figure 6-21).

Figure 6-21: Selection menu RTD2



This menu permits selection of the RTD type to measure the temperature at the cold junction point.

Choice between the following measuring elements:

- **Off**
  No sensor selected
- **Pt100 (2)**
  Platin temperature sensor, basic resistance 100 Ω
- **Ni100 (2)**
  Nickel temperature sensor, basic resistance 100 Ω
- **Ni120 (2)**
  Nickel temperature sensor, basic resistance 120 Ω

Note
Measurements of the cold junction temperature for thermocouple measurements, can be made with any RTD, connected to this card. The assignment of the cold junction measuring point to the RTD is made in menu **Cold junction compensation**.

Click on the appropriate sensor type then click **OK** to confirm the choice.

The program returns to application window **Configuration**. The selected sensor, in this example, is a Platin temperature sensor Pt100. It is shown in the parameter fields just below the thermocouple parameters. Measuring range for this sensor is -200 to +850°C. If necessary, the parameter field **Temperature offset B** permits correction of the cold junction temperature by entering an offset value.

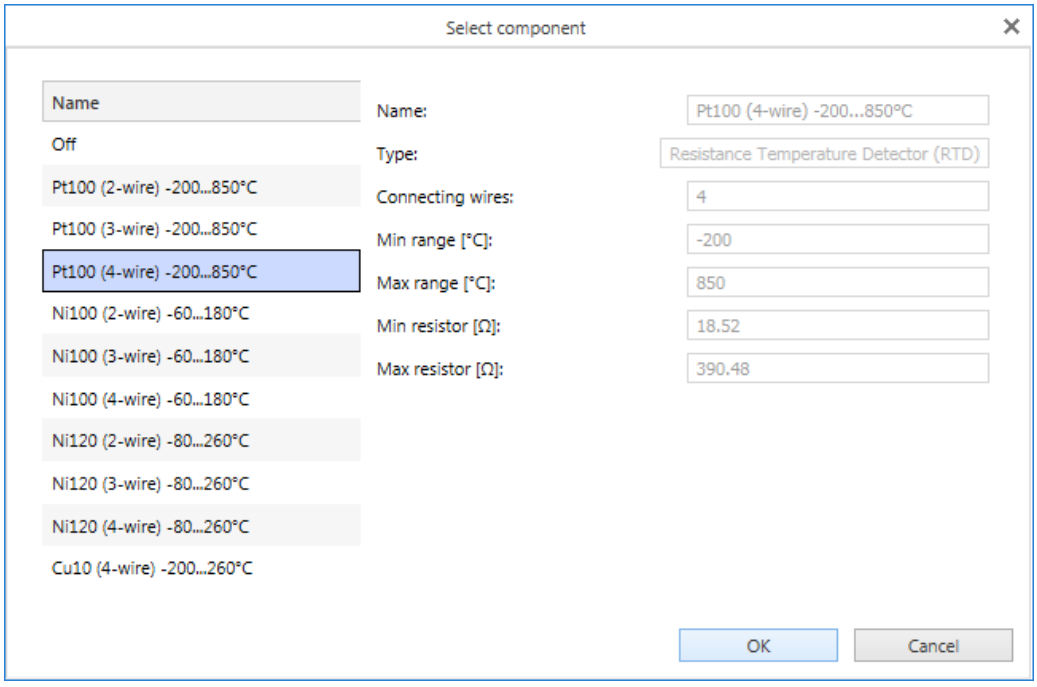
Lower analysis range B [°C]	Enter the lower limit value for the analysis range.
Upper analysis range B [°C]	Enter the upper limit value for the analysis range.

Temperature offset B [°C]	Use this field if the temperature can not be measured directly and the temperature difference between the actual measurement point and the installation place of the temperature sensor is known. Enter the temperature difference (offset). Permissible shift range -200 to +300°C.

Temperature Measurement with RTDs

This measuring function can only be selected for subchannel B. Select measuring function **RTD's** by clicking on this line in field **Input type**. Click on the selection button ... right of line **Sensor** to open submenu **Select component**. See Figure 6-22.

Figure 6-22: Selection menu RTD sensors



Choice between the following measuring elements:

- **Off**
  No sensor selected
- **Pt100 (2)**
  Platin temperature sensor, 100 Ω / 0°C, 2-wire connection, -200 to 850°C
- **Pt100 (3)**
  Platin temperature sensor, 100 Ω / 0°C, 3-wire connection, -200 to 850°C
- **Pt100 (4)**
  Platin temperature sensor, 100 Ω / 0°C, 4-wire connection, -200 to 850°C
- **Ni100 (2)**
  Nickel temperature sensor, 100 Ω / 0°C, 2-wire connection, -60 to 180°C

- **Ni100 (3)**
  Nickel temperature sensor, 100 Ω / 0°C, 3-wire connection, -60 to 180°C
- **Ni100 (4)**
  Nickel temperature sensor, 100 Ω / 0°C, 4-wire connection, -60 to 180°C
- **Ni120 (2)**
  Nickel temperature sensor, 120 Ω / 0°C, 2-wire connection, -80 to 260°C
- **Ni120 (3)**
  Nickel temperature sensor, 120 Ω / 0°C, 3-wire connection, -80 to 260°C
- **Ni120 (4)**
  Nickel temperature sensor, 120 Ω / 0°C, 4-wire connection, -80 to 260°C
- **Cu10 (4)**
  Copper temperature sensor, 10 Ω / 25°C, 4-wire connection, -80 to 260°C

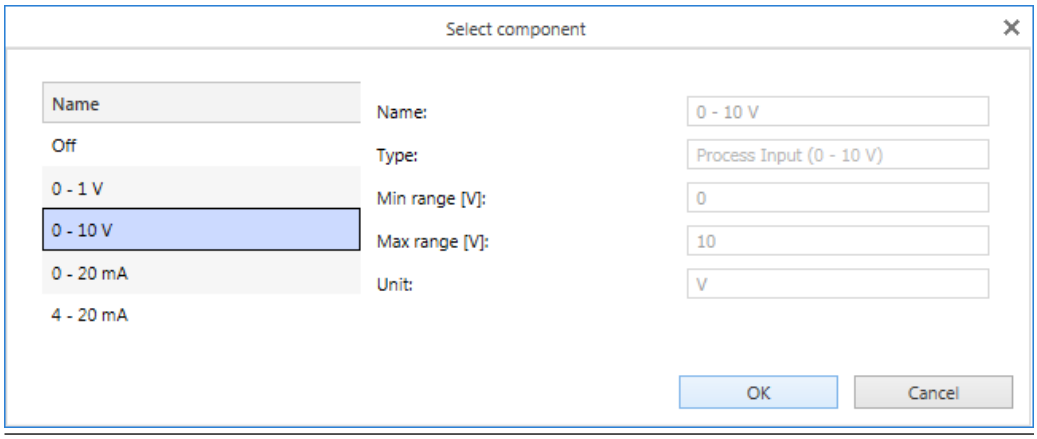
In this example the temperature measurement with Pt100 in 4-wire connection and a measuring range of -200 to 850°C has been selected. The parameters in the right part of the menu are for information only and cannot be modified in this menu. Changes of the measuring range or temperature are only possible in application window **Configuration**.

Click **OK** to confirm the selection, the program returns to window **Configuration**. If necessary, the measuring range may be modified in lines **Lower analysis range [°C]** and **Upper analysis range [°C]**, the last line in the table permits correction of the measuring value by entering a temperature offset.

Measurement of process values

Select measuring function **Process values** by clicking on this line in field **Input type**. Click on the selection button ... right of line **Sensor** to open submenu **Select component** (see Figure 6-23).

Figure 6-23: Selection menu process values



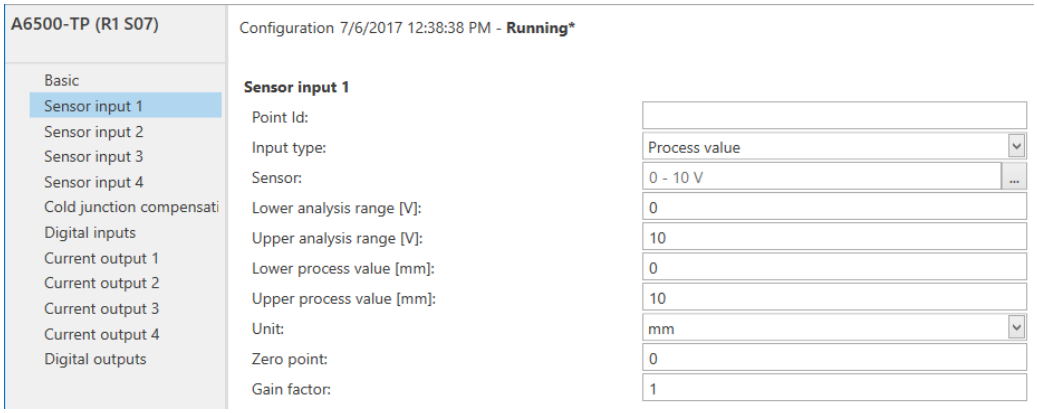
Menu **Sensor component** shows a list of options for this function:

- **Off**
  No function.

- **0 - 1 V**
  Measurement of dc-voltage, maximum value 1 V.
- **0 - 10 V**
  Measurement of dc-voltage, maximum value 10 V.
- **0 - 20 mA**
  Dead-zero dc current measurement, input impedance 200 Ω.
- **4 - 20 mA**
  Life-zero dc current measurement, input impedance 200 Ω.

Click on the required range then click **OK** to confirm the selection. Figure 6-24 shows the input page for configuration of process input signals.

Figure 6-24: Application window, selection process value 10 V



Point ID	Enter the description for the measuring point at the machine.
Input type	By clicking on the pull-down menu in the right part of this line, a list of measuring functions appears. Click a measuring function to select it.
Sensor	Click on the selection button ... to open the dialog for the selection of the measuring range.
Lower analysis range [X]	(X = [V] or [mA]) Enter the lower limit value for the analysis range.
Upper analysis range [X]	(X = [V] or [mA]) Enter the upper limit value for the analysis range.
Lower process value [unit]	Enter the lower limit value for scaling the process value. The entered value must be smaller than the upper process value.
Upper process value [unit]	Enter the upper limit value for scaling the process value. The entered value must be greater than the lower process value.
Unit	Click the arrow to the right in this line to open a drop-down menu with units. Click a unit to select it.
Zero point	Enter a value to shift the zero pint of the process value range.
Gain factor	Enter a value to change the slope of the scaled output characteristic.

Parameter **Zero point** serves the shifting of the zero point, for example, if the zero indication of the protection card is different to the zero point of the signal source.

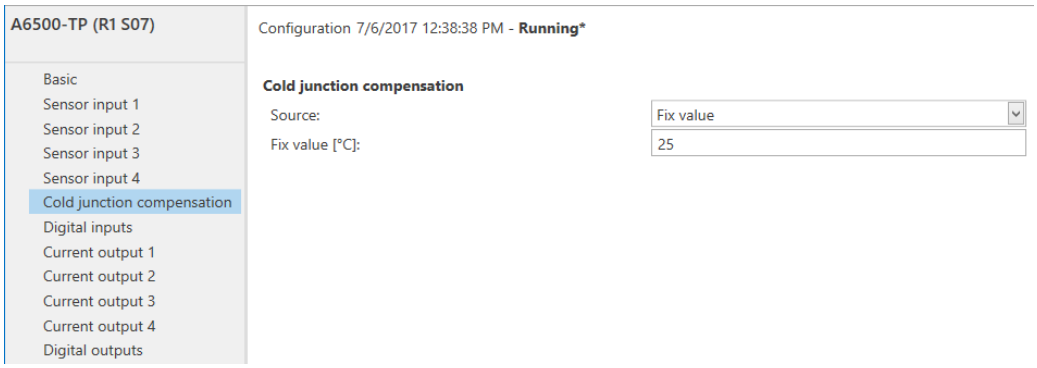
Parameter **Gain factor** serves the correction of the indication by slightly varying the slope of the characteristic in the range 0.9 . . . 1.1.

According to your application, configure **Sensor input 2** to **Sensor input 4** in the same way as described above for **Sensor input 1**.

6.5.4 Cold junction compensation

The cold junction point is the point where the wires of the thermocouple come into contact with other metals for example, copper wires. The temperature at this cold junction point has to be determined for compensation to calculate the correct temperature of the hot junction point (see Figure 6-25).

Figure 6-25: Cold junction compensation



The **Cold junction compensation** menu shows two input options: **Fix value** or **Sensor input x - Temperature**.

Parameter cold junction compensation is necessary for thermocouple measurements. The program offers two options for this parameter:

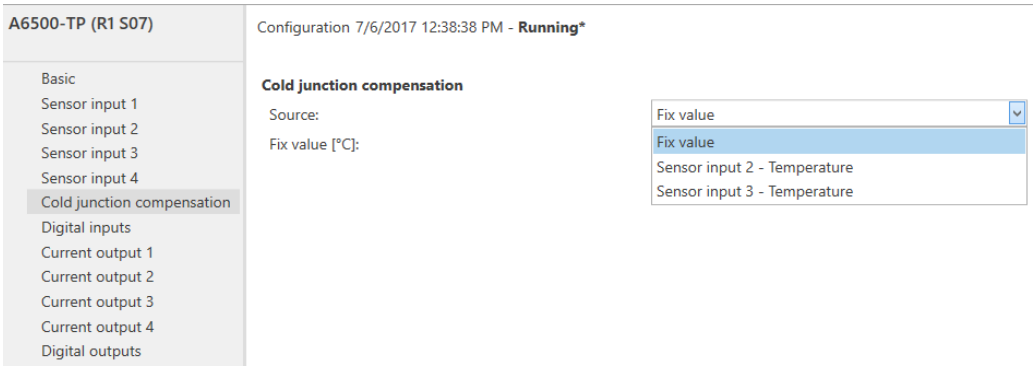
- **Fix value**
  The temperature at the point where compensating lines are connected to copper lines must be entered. In order to achieve a correct measurement, the temperature at this point has to be very stable and constant. Any change of the temperature will directly influence the measuring result.
- **Sensor input x - Temperature** (x = channel number 1 to 4)
  Measuring channel equipped with an RTD. This sensor has to be placed as close as possible to the connection point of compensating line and copper cable.

When using option **Fix value**, enter the temperature in the menu shown in the picture above.

When using option **Sensor input x - Temperature**, open the drop down menu by clicking the arrow to the right in this line. The program will shown all channels with measuring function RTD. Select the sensor that is used for the measurement of the cold junction temperature and confirm your choice with a click on the according line. For example, see **Sensor input 2 - Temperature** shown in the example below.

With this choice, the RTD-sensor connected to channel 2 of this card is now defined for the measurement of the cold junction temperature and applies for all thermocouple channels of this card (see Figure 6-26).

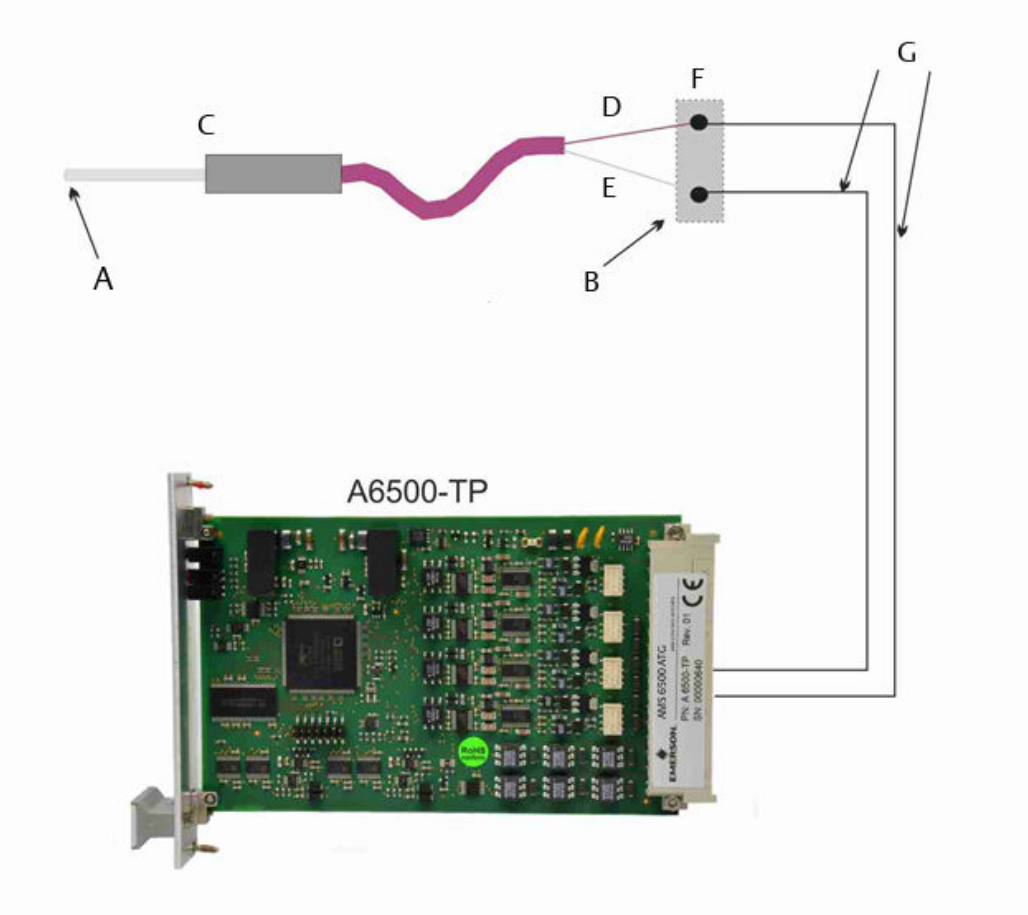
Figure 6-26: Cold junction compensation - selection example



Cold junction compensation, option Fix value

Place the connection point of the thermocouple in a closed box with a constant temperature and enter this temperature in the configuration software - line **Fix value** (see Figure 6-27).

Figure 6-27: Cold junction compensation, constant temperature



A. Hot junction point
B. Cold junction point
C. Thermocouple
D. Metal 1
E. Metal 2
F. Constant temperature
G. Copper wires

⚠ CAUTION

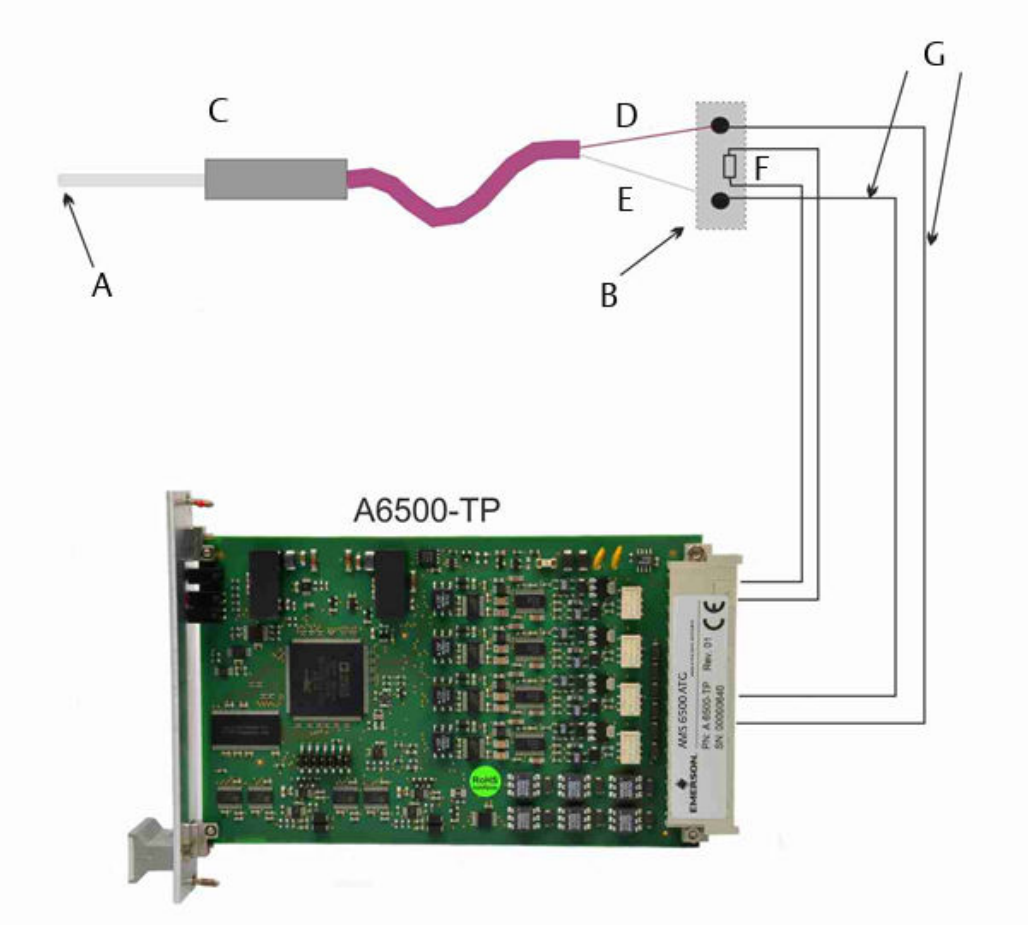
Any change of the temperature at the cold junction point will directly influence the thermocouple measuring result.

Cold junction compensation, option Sensor input x - Temperature

The more precise way is to measure the temperature at the point where the wires of the thermopair come into contact with copper wires (see Figure 6-28). This is usually the

signal input of a measuring device or the input of a cold junction box. When installing A6500-TP Temperature Process Cards, the RTD for measuring the cold junction temperature may be connected to any input channel and applies for all thermocouple channels of this card.

Figure 6-28: Cold junction compensation, measured value with RTD sensor



A. Hot junction point
B. Cold junction point
C. Thermocouple
D. Metal 1
E. Metal 2
F. Pt 100
G. Copper wires

Click on the drop down button to the right of line **Source** and select option **Sensor input X - Temperature**.

With this selection, the terminal contacts of input X must be installed with an RTD sensor for the measurement of the cold junction temperature. The sensor may be installed in 2-pole, 3-pole or 4-pole connecting mode.

More detailed information on the installation of the temperature resistor are shown in the A6500-xR System Racks operating manual (MHM-97877). The configuration of this sensor is described in Temperature measurement with thermocouple and RTD2.

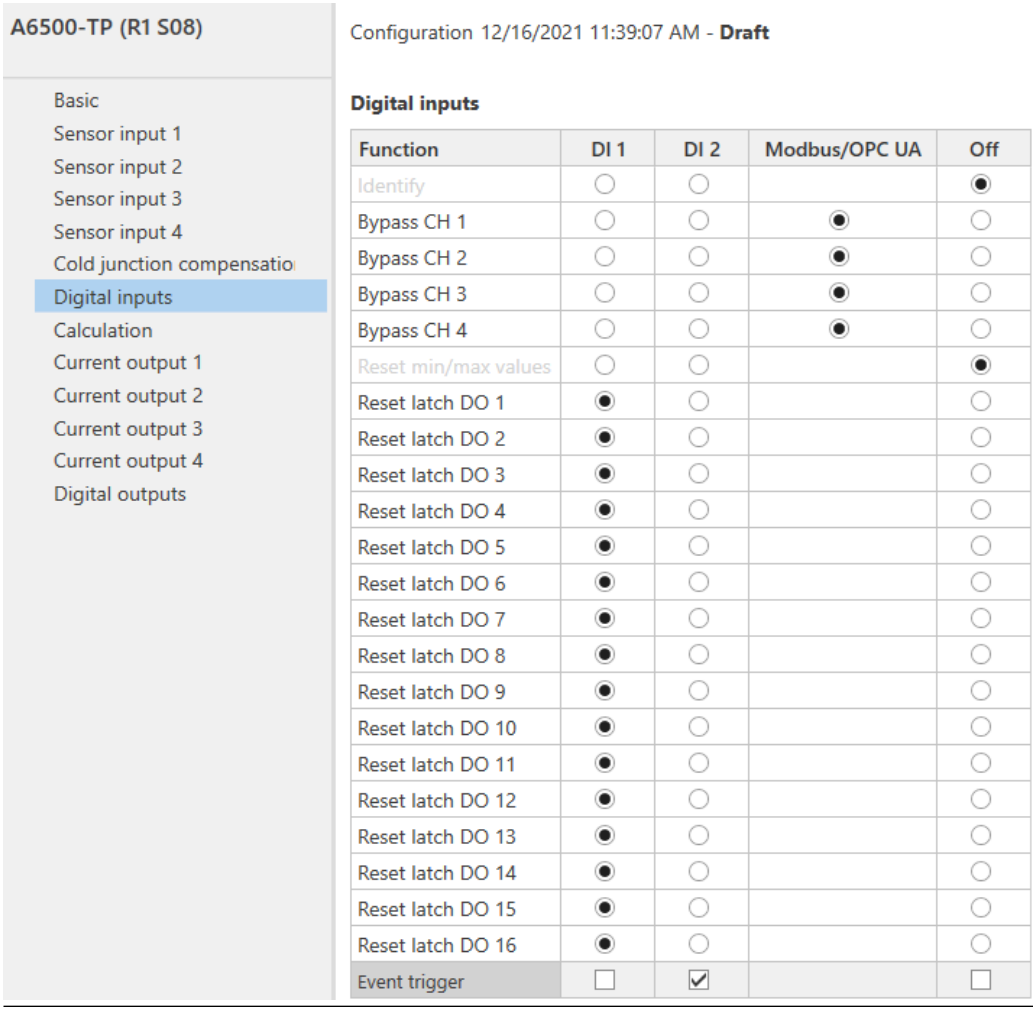
6.5.5 Digital inputs

The A6500-TP Temperature Process Card has two digital inputs to control several functions.

To configure the digital inputs, assign a digital input to the function to be controlled, see Figure 6-29.

To control the four channel bypasses through the Modbus or OPC UA interface, select **Modbus/OPC UA** for the channel to be bypassed. The typical reaction time for a command through the Modbus or OPC UA interface is approximately one second. The reaction time is the time between sending the command and the recognition of the command by the A6500-TP Card. The reaction time might be higher at a high input load.

Figure 6-29: Digital inputs



Digital input 1 **DI1** and digital input 2 **DI2** can be assigned to the functions shown in column **Function**. Activate the functions by clicking the radio button in the corresponding field, a selected function is indicated by a filled circle.

Identify

When an active low signal pulse is sent to a digital input, the LEDs "Alarm 1", "Alarm 2", and "OK" of the addressed protection card start flashing in circular sequence for about 15 seconds for identification purposes. With a continuous signal at the digital input, the LEDs on the card front will be flashing continuously.

The Identify function is useful for the recognition of individual cards in cabinets with several installed racks. Alternatively, this function can be triggered with a click on command **Identify** in screen display **Overview** of the respective protection card.

Bypass CH 1 to Bypass CH 4

Disable the input channels channel by channel. An input channel with activated bypass is disabled and all functions assigned to this channel are inactive. See Bypass.

⚠ DANGER

Bypassed input channels are not part of the machine protection while Bypass is activated.

Reset min/max values

With a digital pulse at one of the digital inputs DI1 or DI2, the indicated minimum and maximum values in menus **Overview** and **Details** will be reset.

Reset latch Out x

(x = alarm output 1 to 16; 1 to 6 physical outputs, 7 to 16 only software outputs (Modbus and OPC))

Digital outputs of the A6500-TP Temperature Process Card may be assigned to any channel and programmed for different alarm monitoring functions with or without latching.

If you have configured a digital output channel with an alarm function with latching, and if this output has indicated an alarm and remains switched on even when the alarm condition is no longer present, the output can be reset with a digital input and function **Reset latch Out x**. Alternatively, this function can also be carried out through AMS Machine Studio with a click on command **Reset latch x** in application window **Home** of the respective protection card.

Event trigger

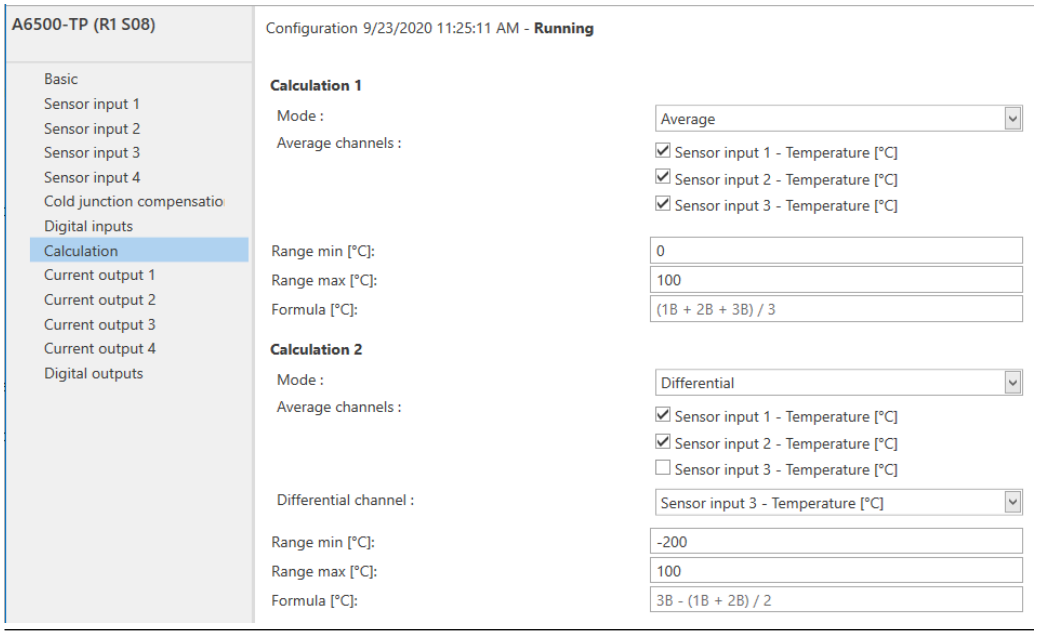
Digital inputs can be used to trigger data capturing. Place a checkmark in the box to activate triggering for the associated digital input. Download the configuration to the A6500-TP card to use the trigger for the configuration of collection tasks (see operating manual **AMS Machine Studio – General Functions** for details).

6.5.6 Calculation

Configure one or two calculations. The result can be selected as a data source for a digital output (see Digital outputs) or assigned to a current output (see Current outputs).

Note
All input channels used for the calculation must have channel status OK, otherwise the calculation cannot be executed.

Figure 6-30: Calculation



Mode Select a calculation mode.

None	Calculation is disabled.
Average	Select **Average** to calculate the arithmetic mean of selectable input channel values.
Differential	Select **Differential** to calculate the difference of an input channel value and the arithmetic mean value (average).
Max deviation	Select **Max deviation** to calculate the deviation between the input channel value and the greatest difference to the arithmetic mean value (average). In this mode, the input channel value with the greatest difference to the average value and the same unit is automatically selected for the calculation.

Average channels All configured input channels available for the calculation are listed. Place a checkmark in the box to select an input channel. Ensure that the values of the selected channels have the same unit.

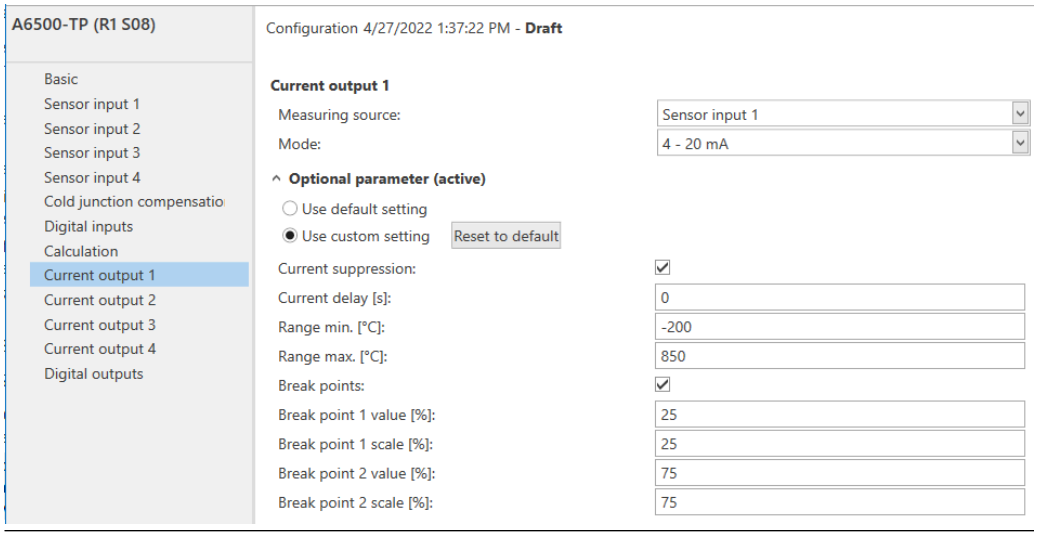
Differential channel Available if **Differential** is selected for **Mode**. Select an input channel to be used for the differential calculation. Ensure that the value of the selected channel has the same unit as the input channels used for the average calculation.

Range min	Enter a value to define the beginning of the range of the calculated value. An assigned current output is scaled on this range.
Range max	Enter a value to define the end of the range of the calculated value.
Formula	The formula used for the calculation is displayed.

6.5.7 Current outputs

The A6500-TP Temperature Process Card is equipped with four current outputs. The outputs can be configured for dead zero, 0 to 20 mA, or life zero range, 4 to 20 mA. For the configuration, click on one of the lines **Current output 1 to 4**. The window shown in Figure 6-31 appears.

Figure 6-31: Current output



Measuring source

Select the sensor input channel to be output via this current output.

The option **No measurement** disables the corresponding current output.

Note

You can select only those channels as output source that have been activated before. Sensor inputs with deactivated measuring function **Off** do not appear in this menu.

Mode

Select the required output current range:

- 0 to 20 mA
- 4 to 20 mA
  Activation of the current suppression function is possible.
- 20 to 4 mA
  Activation of the current suppression function is possible.
- 20 to 0 mA

By using the life zero range 4 to 20 mA, externally connected devices can be able to detect wire breaks or system failures. A drop of the output current below 4 mA indicates a malfunction or wire break.

Optional parameter – current output

Click the down arrow in front of **Optional parameter** to open additional parameters for the current output.

Use default setting
Select this option to use the default settings.

Use custom setting
Select this option to individually adjust the settings to the measuring task.

To reset the settings to the default values, click **Reset to default** behind this option.

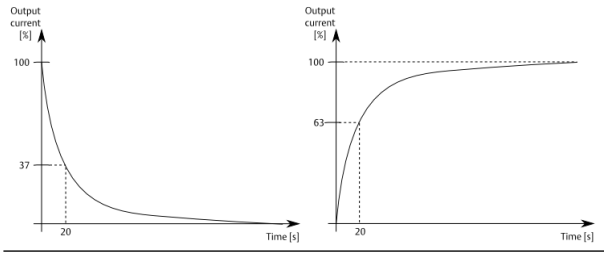
Current suppression
Available for ranges 4 to 20 mA and 20 to 4 mA.

Place a checkmark in the box to activate the current suppression. The function is active if the box is marked. In case of a fault, the current is set to 0 mA.

Current delay [s]
In order to achieve stable output currents at unstable or disturbed measuring values, enter a time in a range of 1 to 20 seconds (0 seconds = no settling) to settle the output current.

The time causes a slow change in the current at fast changes of the measurement value. With a time of 20 seconds and a sudden change of the measurement value from 100% to 0% it will take approximately 20 seconds until the current has dropped by 63% (left diagram in Figure 6-32). The right diagram in Figure 6-32 shows the change curve for a sudden change of the measurement value from 0 to 100%.

Figure 6-32: Diagram current output settling



Range min. and Range max.
Use these parameters for scaling the current output on a reduced measuring range. Enter the range minimum and the range maximum of the needed measuring range.

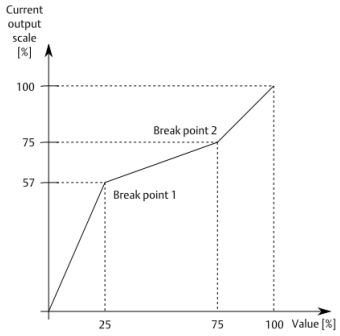
Break points
Use this function to divide the linear current output curve into an output curve with up to three linear parts with different gradients. Place a checkmark in the box to activate the break point function. After activation, four parameters for defining the break points appear:

- Break point 1 value [%]

- Break point 1 scale [%]
- Break point 2 value [%]
- Break point 2 scale [%]

The break points are defined in percent of the configured output range and measuring range. Figure 6-33 shoes a break point example with a first break point at value 1 = 25% and scale 1 = 57% and the second break point at value 2 = scale 2 = 75%

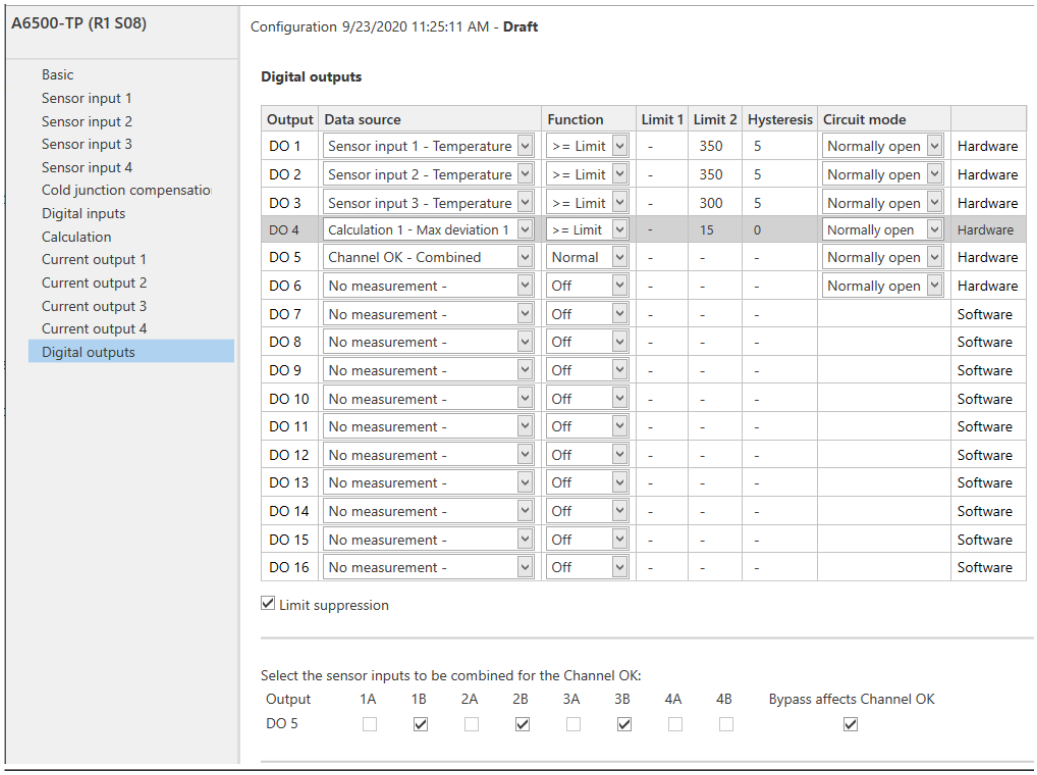
Figure 6-33: Example diagram break point



6.5.8 Digital outputs

The A6500-TP Temperature Process Card is equipped with six hardware digital outputs and ten software digital outputs for supervision of measuring results and indication of alarm states. All outputs (DO 1 to DO 16) are available through Modbus and OPC UA communication. The six outputs DO1 to DO6 are also assigned to the six hardware outputs of the card.

Figure 6-34: Digital outputs



Configure a hardware or software output.

1. Assign a data source to a hardware or software output.
2. Select a function for the measuring result supervision.
3. Enter limits depending on the select function.
4. If needed, enter a hysteresis.
5. If a hardware output is used, select a circuit mode.

Repeat these steps for all data sources to be supervised.

Column description of the **Digital outputs** table:

Output	Number of the digital output. DO 1 to DO 6 are hardware outputs. DO 7 to DO 16 are software outputs.
Data source	Available data sources depend on the card configuration. A data source could be a configured sensor input, result of a calculation, or the Channel OK supervision. When data source **Channel OK - Combined** is selected, a sensor inputs selection field appears below the **Digital outputs** table. Each configured subchannel has a check box assigned. By selecting individual status outputs with a checkmark, these outputs will be AND operated to switch the according digital output. The output will be

switched when all selected subchannels show the OK state. If one of these outputs fails, the assigned digital output will be switched off. The data source **Channel OK - Combined** can be assigned to hardware outputs.

Function Available functions for a data source. Different alarm functions are not available when data source **Channel OK - Combined** is selected. The function is set to **Normal** as the result of the Channel OK supervision switches directly the digital output, without any limit supervision.

Off No alarm function activated.

>= Limit The effective direction of this alarm is increasing, the alarm is triggered if the measuring value exceeds the defined limit. If the value falls below the limit again (limit value minus hysteresis), the alarm is reset.

>=Limit (Latch) The effective direction of this alarm is increasing, the alarm is triggered if the measuring value exceeds the defined limit. If the value falls below the limit again (limit value minus hysteresis), the alarm is only reset if a reset-latch command is given (see Digital inputs, **Reset latch Out x**).

<= Limit The effective direction of this alarm is decreasing, the alarm is triggered if the measuring value falls below the defined limit. If the value exceeds the limit again (limit value plus hysteresis), the alarm is reset.

<= Limit (Latch) The effective direction of this alarm is decreasing, the alarm is triggered if the measuring value falls below the defined limit. If the value exceeds the limit again (limit value plus hysteresis), the alarm is only reset if a reset-latch command is given (see Digital inputs, **Reset latch Out x**).

Window Use the limit values **Limit 1** and **Limit 2** to define a limit window. The function output is set if the measured signal level exceeds or falls below one of the two limit values (see Figure 6-35).

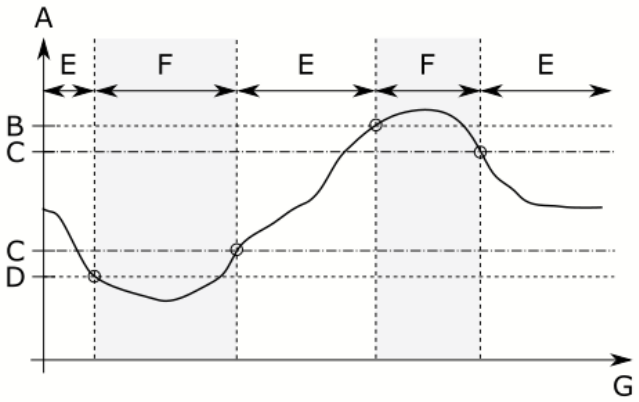
The function output remains in its initial state as long as the measuring value remains within the limits.

Window (Latch) Use the limit values **Limit 1** and **Limit 2** to define a limit window. The function output is set if the measured signal level exceeds or falls below one of the two limit values.

The function output is in its initial state as long as the measuring value remains within the limits.

If the measuring value exceeds a limit and then returns within the limits (limit value 1 plus hysteresis and limit value 2 minus hysteresis), the alarm is only reset if a reset-latch command is given (see Digital inputs, **Reset latch Out x**).

Figure 6-35: Alarm function "Window"



A. Measuring value
B. Limit 2
C. Hysteresis
D. Limit 1
E. No alarm
F. Alarm
G. Time

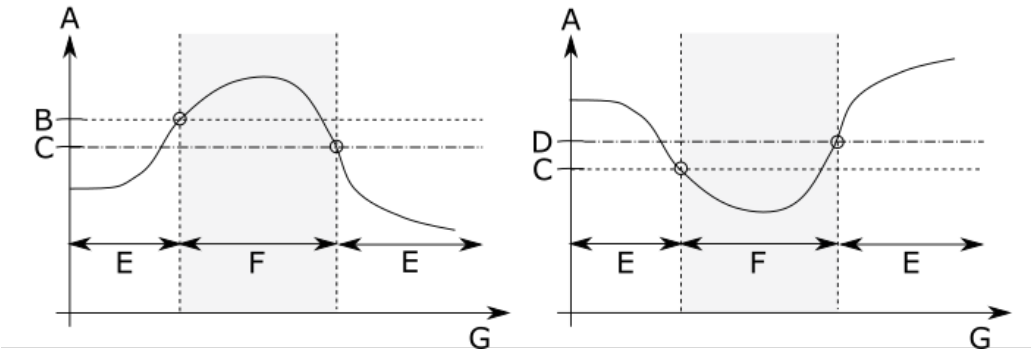
Limit 1 Limit value for defining an alarm window. This input field appears when the alarm function **Window** or **Window (Latch)** has been selected.

Parameter **Limit 1** must always be smaller than **Limit 2**.

Limit 2 Limit value for alarm supervision. This limit value applies to all alarm supervision functions.

Hysteresis Definition of the hysteresis. The hysteresis is intended to prevent an undefined reaction the of alarm outputs when the measured value is close to the limit value. The hysteresis determines criteria for an alarm to be reset after a measurement value has exceeded a limit. The left diagram in Figure 6-36 shows the behavior of a hysteresis at a greater than or equal to alarm limit. The right diagram in Figure 6-36 shows the hysteresis behavior at a lower than or equal to alarm limit.

Figure 6-36: Hysteresis



A. Measuring value
B. >= Limit
C. Hysteresis
D. <= Limit
E. No alarm
F. Alarm
G. Time

Circuit mode Select here the operating principle of the hardware digital outputs DO 1 to DO 6. Circuit mode selection is not available for the software digital outputs.

Normally open With activated alarms, the output is conductive and an externally connected relay activated.

Normally closed With activated alarms, the output is disabled and an externally connected relay deactivated.

Additional parameter below the **Digital outputs** table:

Limit suppression Activate this function to suppress the alarm limits as soon as Channel OK is no longer present because of sensor failures. All other conditions (card malfunctions and activated bypass) that could lead to the suppression of the alarms, remain unaffected by this parameter.

Note
Limit values suppressed means that the alarm outputs (digital outputs) are in their initial state (no “Alarm”).

Bypass affects Channel OK Click the checkbox to enable that a bypassed channel affects Channel OK. Behavior if a channel is bypassed:

- Box checked and bypass activated:
  A digital output with **Data source → Channel OK - Combined** is switched into the channel not OK condition which depends on the configuration of **Circuit mode**.

Note
An enabled **Bypass affects Channel OK** only affects a digital output with **Data source → Channel OK - Combined**. An enabled **Bypass affects Channel OK** does not affect Channel OK of the single channels (sensor input 1a/1b to sensor input 4a/4b). With activated bypass, Channel OK is always switched off, independently of the setting **Bypass affects Channel OK**. All functions and display elements related to Channel OK such as OK LED, limit suppression, and current suppression react accordingly.

- Box not checked and bypass activated:
  An activated bypass does not affect a digital output with **Data source → Channel OK - Combined**.

Example configuration

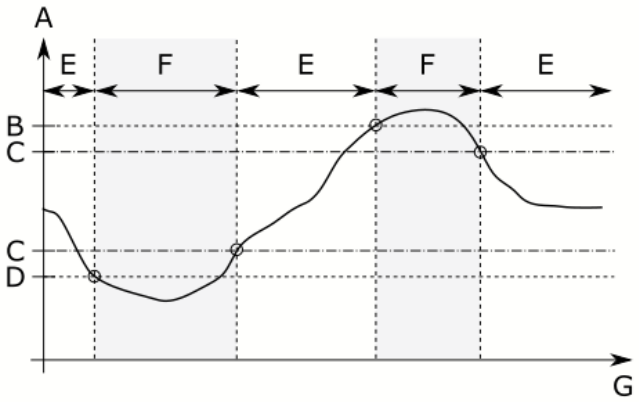
Example for alarm settings and digital output behavior:

Digital output 1 is assigned to a temperature measurement of channel 1. The output will switch when the limit 450°C is exceeded, and will switch off, when the temperature falls again below 430°C (450°C minus 20°C hysteresis). The circuit mode of this output is **Normally open**. This means in initial state the output is 0 V, in alarm state the output will be 24 V.

Digital output 2 is assigned to a process voltage measurement of channel 2 with 10 V measuring range. The output will switch when the limit 5 V is exceeded, and will switch off again, when the voltage falls below 4 V (5 V minus 1 V hysteresis). The circuit mode of this output is **Normally closed**. This means in initial state the output level is 24 V, in alarm state the output will switch to 0 V.

Digital output 3 is assigned to a temperature measurement of channel 3, subchannel B. The output remains in initial state as long as the temperature is within 100°C and 300°C. The alarm output will switch when the limit 300°C is exceeded or when the measuring value falls below 100°C (see Figure 6-37).

Figure 6-37: Alarm function "Window" - example



A. Measuring value
B. Limit 2: 300°C
C. Hysteresis: 5°C
D. Limit 1: 100°C
E. No alarm
F. Alarm
G. Time

The output will switch off again, when the temperature falls below 295°C (300°C minus 5°C hysteresis) or increases over 105 °C (100°C plus 5°C hysteresis) and when a command or signal reset latch was sent to the card. The circuit mode of this output is **Normally open**. This means in initial state the output is 0 V, in alarm state the output will switch to 24 V.

6.6 Send and reload a configuration

6.6.1 Send a configuration

⚠ CAUTION

The machine protection function of the card is disabled during sending of configurations with major changes, because of a reboot of the A6500-TP Card.

Note
Modbus requests are answered with **Server Device Busy (0x06)** when sending a configuration.

Whether or not a reboot is required will depend on the changes to the configuration. The following changes do not require a reboot of the card:

- Names and texts
- Alarm limits
- Alarm related settings such as delay, latching, alarm hysteresis, and limit suppression.

Procedure

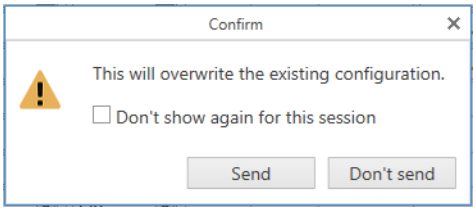
1. Ensure that there is an online connection between the A6500-TP Card and AMS Machine Studio running on a PC or laptop.

   AMS Machine Studio will automatically establish an online connection to the cards of the AMS 6500 ATG system as soon as there is a physical connection through the USB port of the A6500-CC Com Card of the system. At TCP/IP connection, click **Connect ATG** on the ribbon command bar of page **Home** to establish a connection.

2. Click **Send & close** in the ribbon command bar to send the configuration to the card.

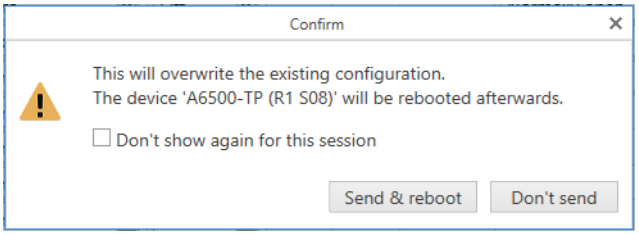
   A confirmation dialog opens in accordance to the boot requirement:

Figure 6-38: Confirmation – overwrite configuration without reboot



Click **Send** to overwrite the existing configuration without reboot.

Figure 6-39: Confirmation – overwrite configuration and reboot required



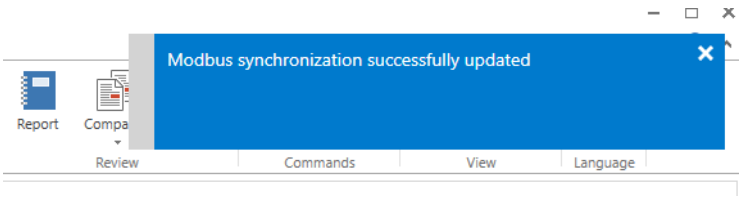
Click **Send & reboot** to overwrite the existing configuration and to reboot the A6500-TP Card afterwards. The machine protection function of the card is disabled during the process.

The configuration editor automatically closes afterwards.

A successful sent configuration will be indicated by a message in the upper right corner of the software window. This message window will automatically disappear. Otherwise close it by clicking on the cross.

The Modbus registers are automatically updated according to the sent configuration unless the AMS 6500 ATG is not protected by a password. The successful update is also indicated by a message in the upper right corner (see Figure 3).

Figure 6-40: Modbus synchronization



The card is ready to use when the "Ok" LED on the card front shows a green steady light.

6.6.2 Reload a configuration

Once an online connection has been established, the configuration of all cards of a AMS 6500 ATG system are automatically loaded to AMS Machine Studio. Click **Reload** in the ribbon command bar if the configuration of the card must be loaded again.

7 Online View

This chapter explains the online view. The measuring signals are acquired by the protection cards, converted to digital signals, scaled on the configured output ranges, and visualized in numeric and graphic diagrams. The screen displays **Overview**, **Details**, and **Live data** are shown in the main view.

7.1 LEDs on the front panel

The A6500-TP Temperature Process Cards are fitted with five LEDs on the front panel.

- **OK**
  Green LED to indicate the status of the card. When this LED lights up, hardware and software condition of the card are OK. This LED also indicates channel OK of all active sensor inputs. The LED will be switched off if any sensor input fault is detected.
- **Alarm**
  Four red alarm LEDs – one for each of the channels. If one of the four channels is in alarm condition, the relevant LED lights up.

Note
Alternate flashing of the alarm LEDs indicates that the card is in the bootloader. If the card sticks in this condition – the LEDs still flash alternately after 10 seconds – set the card to factory default (see Ribbon command bar) and configure the card anew.

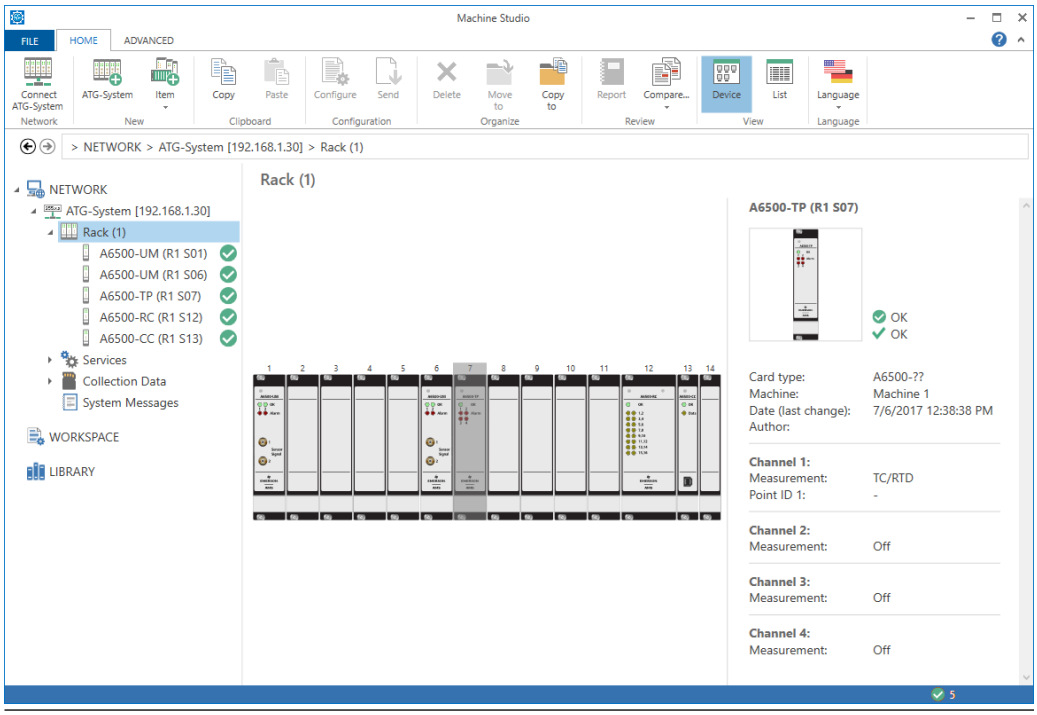
7.2 Main view

When starting AMS Machine Studio, a window is shown with a tree structure on the left with designations and locations of all installed cards, and with a graphic of the system rack showing card states and the states of alarm outputs (see Figure 7-1).

Information on all functions of the configuration software are shown in more detail in the AMS Machine Studio operating manual.

By clicking on one of the devices in the tree structure, screen display **Overview** opens and displays measuring values in numeric and graphic form, channel states, the card state, and the current state of the alarm outputs.

Figure 7-1: Main view with graphic of system rack



In this example, an A6500-SR System Rack is connected to the computer. The rack is fitted with one A6500-TP Temperature Process Cards, two A6500-UM Universal Measurement card, one A6500-RC Relay card, and one A6500-CC Com Card (see Table 7-1).

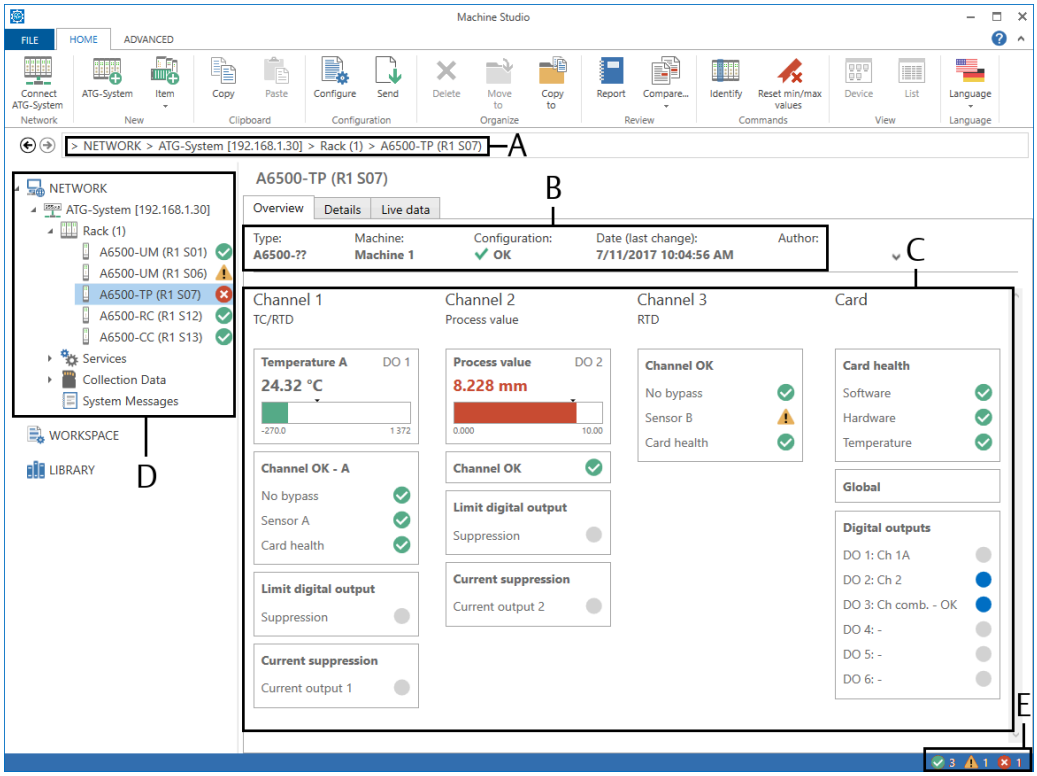
With a click on one of the devices in the tree structure on the left, the visualization menu opens.

Table 7-1: Rack view example

Network		
ATG System	**Card**	**Addressing**
A6500-SR	A6500-CC (R1 S13)	**R**ack **1**, **S**lot **13**
	A6500-RC (R1 S12)	**R**ack **1**, **S**lot **12**
	A6500-TP (R1 S07)	**R**ack **1**, **S**lot **07**
	A6500-UM (R1 S06)	**R**ack **1**, **S**lot **06**
	A6500-UM (R1 S01)	**R**ack **1**, **S**lot **01**

By clicking on a A6500-TP card in the tree structure, the following display opens.

Figure 7-2: Online view Overview



A. Navigation bar
B. Device tree
C. Information field
D. Display fields
E. Status information – System Rack

There are two small additional icons, **Not in sync** and **No configuration**. These icons appears on card symbol in the **Network** list if the card is not in sync or has no configuration.

Not in sync

Figure 7-3: Not in sync

An Temperature Process Card not in sync is marked with this symbol. An Temperature Process Card is "not in sync" if there is a draft configuration that has been not yet send to the card. For example, a digital output configuration of an A6500-TP cards has been changed and this change has been saved as draft.

1. Click the Temperature Process Card not in sync in the listed of connected devices below **Network** to select the card. The row will be colored blue.

2. Click **Configure** in the ribbon command bar to open the editor.
3. Check the configuration.
4. Click **Send & close** to synchronize the card.
   The configuration of the Com Card is sent. The "not in sync" sign disappears after successful sending of the configuration.

No configuration

Figure 7-4: No configuration

An Temperature Process Card without a configuration is marked with this symbol. This card state is also indicated by slowly alternate flashing of the green OK LED on the front plate.

Information field

This part of the screen shows information on the states of hardware and software of the selected card (see Figure 7-5).

Figure 7-5: Information field

- **Serial**
  Shows the serial number of the card – this card has SN: 647.
- **Module type**
  Hardware type of the selected protection card – A6500-TP in this example.
- **Firmware**
  Firmware version on the selected card – 2.0.0.95 in this example.
- **Hardware**
  Revision of the hardware of the selected card – Rev. 01 in this example.
- **Last change**
  Date and time of last parameter modification.
- **Author:**
  Name of the person who last made changes to the software.
- **Machine**
  Machine designation.
- **Config state**
  State of the card configuration.
- **Plant**
  Plant name.

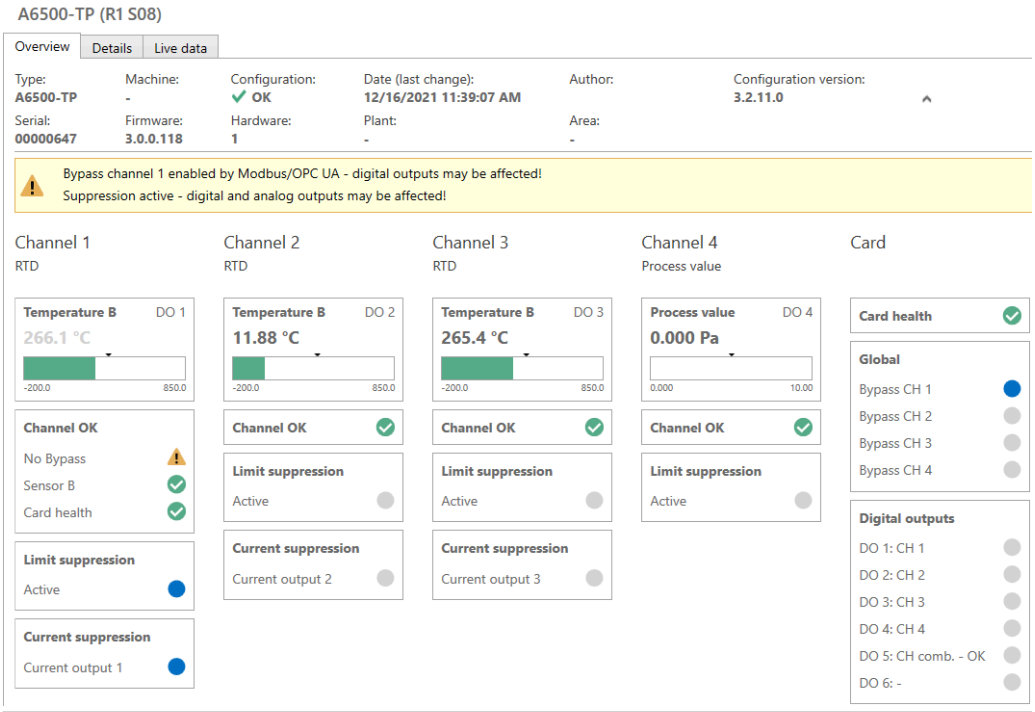
- **Area**
  Name or short description of the area where the machine is located.

7.3 Display fields

7.3.1 Overview

The display field of the screen provides an overview of measuring results and card states (see Figure 7-6).

Figure 7-6: Display field "Overview"



This field shows measuring results and status information of all four channels.

To the right of this display field, the screen shows information on the card states of the internal supervision functions:

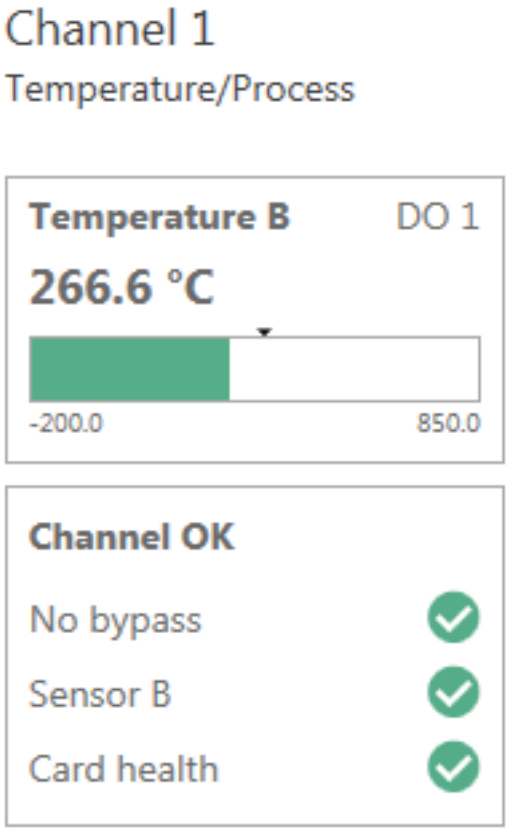
- **Software**
  Software watchdog
- **Hardware**
  Supervision of Channel OK
- **Temperature**
  The current temperature on the card is measured continuously with an internal temperature sensor.

If one of these states changes to red, the proper supervision function of the card can no longer be guaranteed.

Displaying RTD measurement

This display shows measuring results and status information of channel 1. In this example, the channel is equipped with a Pt100 at subchannel 1B. Measuring range for this sensor is -200 to 850°C.

Figure 7-7: Measuring results, RTD measurement



The upper display field shows:

- Measuring function - in this example temperature measurement subchannel B.
- Measuring result with measuring unit.
- Bar diagram with indication of min and max value of measuring range.

The display field below shows channel and card state. Click **Channel OK** to expand the object and get more information about the channel state (see Table 7-2).

Table 7-2: Flags Channel OK

Flag	Meaning		Action
No Bypass		Bypass is not active	---

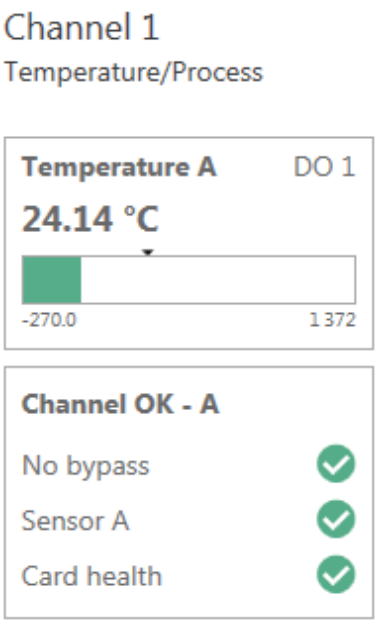
Table 7-2: Flags Channel OK *(continued)*

Flag	Meaning		Action
	⚠	Bypass is active	Open GND connection at the corresponding digital input.
Sensor	✓	No fault detected.	---
	⚠	Sensor fault detected	Check the sensor including wiring and connections
Card health	✓	No fault detected.	---
	⚠	Card fault detected.	For more details see graphic object "Card health".

Displaying thermocouple measurement

This display shows measuring results and status information of channel 1. In this example, subchannel 1A is equipped with a thermocouple type K.

Figure 7-8: Thermocouple measurements



The headline of the indication shows channel number and channel Id. See Figure 7-8.

- Measuring result subchannel A [°C] with min/max values and measuring unit.
- Bar diagram with indication of min and max value of measuring range.

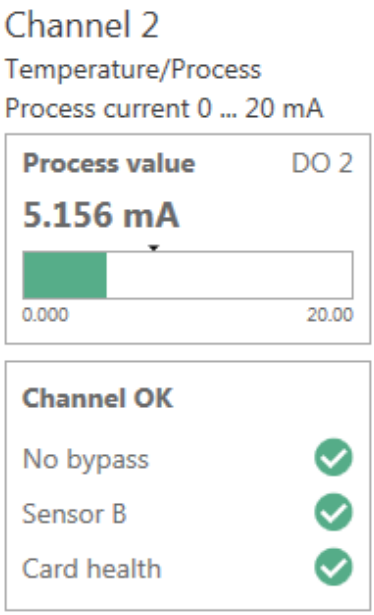
The display field below shows channel and card state. Click **Channel OK** to expand the object and get more information about the channel state (see Table 7-2).

Displaying process voltages

Example 1

The display shows measuring results and status information of a channel programmed for the measurement of measuring process voltages. Measuring range is 0.000 to +10 V, and process value range is also 0 to 10 V. The bar usually appears in green color if a limit value has been defined and if this limit is exceeded, the color of the bar changes to red (see Figure 7-9).

Figure 7-9: Process voltage - Example 1



The upmost display shows:

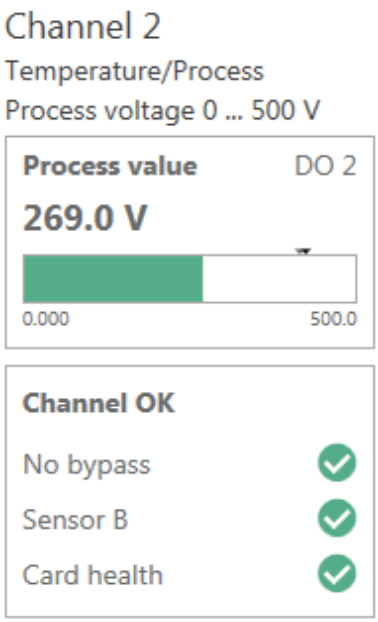
- Measuring function - process voltage
- Process value with measuring unit [V] and
- Bar diagram with indication of min/max value of measuring range

The display field below shows the channel status **Channel OK**, which means the channel is measuring properly. The green circle **Card health** indicates that the card is measuring properly, which means that no hardware or software fault was detected by the internal supervision function and the internal temperature has not exceeded the limit. See Table 7-2 for details.

Example 2

This example shows measuring results and status information with a scaled process output. Measuring range is 0 to +10 V, and the process output is scaled for a range 0 to 500 V. This effects an output of 500 V with a signal input 0 to 10 V. Min and max values of the output range is indicated to the left and right hand side of the bar (see Figure 7-10).

Figure 7-10: Process voltage - Example 2



The upmost display shows:

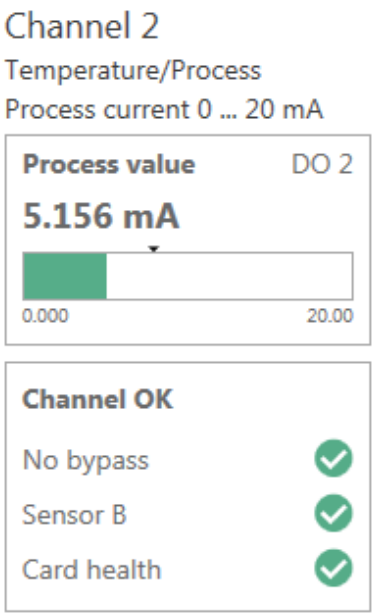
- Freely programmable Point Id - "Process voltage 0 to 500 V".
- Measuring function - process voltage.
- Measuring result with measuring unit [V] and
- Bar diagram with indication of min/max value of measuring range

The display field below shows the channel status **Channel OK**, which means the channel is measuring properly. The green circle **Card health** indicates that the card is measuring properly, which means that no hardware or software fault was detected by the internal supervision function and the internal temperature has not exceeded the limit. See Table 7-2 for details.

Displaying process currents

This display shows measuring results and status information of a channel, programmed for measuring process currents. Measuring range is 0.000 to 20.00 mA. Usually the bar is green. When the limit value is exceeded, provided it was programmed, the bar color changes to orange. See Figure 7-11

Figure 7-11: Process current indication



The upmost display shows:

- Freely programmable Point Id - "Process current 0.000 to 20.00 mA".
- Measuring function - process value.
- Measuring result with measuring unit [mA] and
- Bar diagram with indication of min/max value of measuring range

The display field below shows a green circle **Sensor B**, which means the channel is measuring properly. The green circle **Card health** indicates that the card is measuring properly, which means no hardware or software fault has been detected by the internal supervision function and the internal temperature has not exceeded the limit. See Table 7-2 for details.

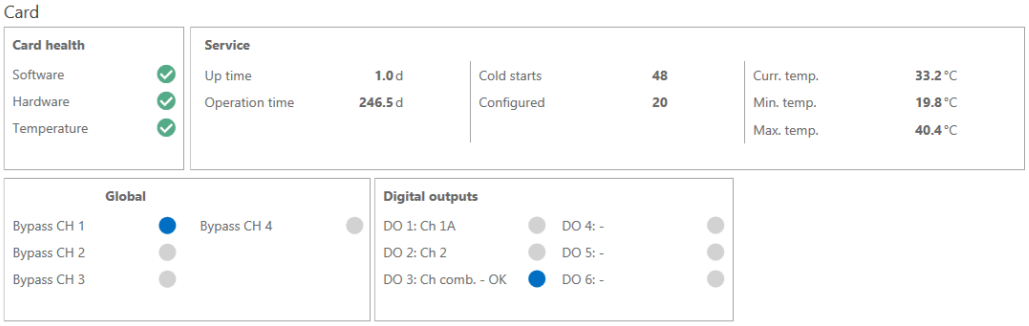
7.3.2 Details

Details displays measuring results together with status information and additional measuring details (see Figure 7-12).

Screen display **Details** offers information on:

- Software status, hardware status, temperature on the card
- Global flags, alarm bypass active or inactive
- Measuring values of all 8 subchannels in numerical form and as bar diagram
- Channel related status information, Sensor A OK, Sensor B OK, Card health OK
- Status values of all 8 subchannels including minimum and maximum values
- Analog outputs, Output values as numerical value and bar diagram

Figure 7-12: Details



Card health Information field **Card health** of the system information shows that no hardware or software fault has been detected by the internal supervision function and the internal temperature has not exceeded the limit. If one of these information changes the state, the indication changes to a yellow triangle to indicate an alert or a red circle to indicate a danger state.

Global This field shows the state of the four channel bypasses. With a gray circle, as shown in the figure above, the function is inactive.

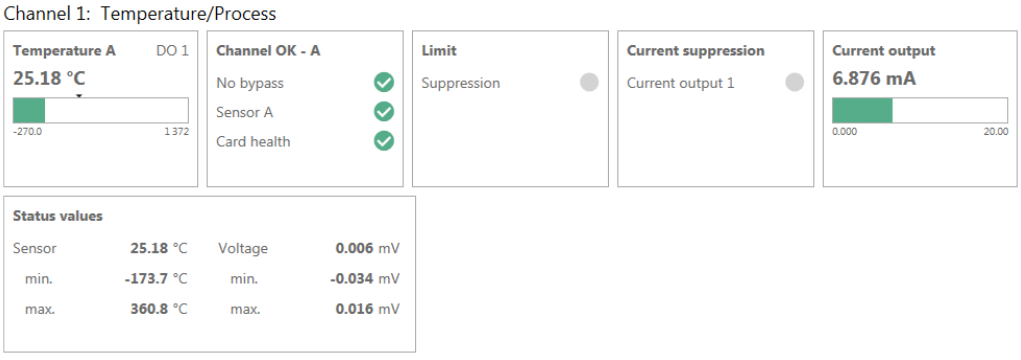
Digital outputs The states of all digital outputs are shown. In this example, all outputs except Digital out 3 are switched off.

Note
Indications of digital outputs show the electrical status. This does not indicate whether the output is active or inactive. For this you have to check which output function – open circuit mode or closed circuit mode – has been selected for this output.

Service data This field provides information on the total operation time of the card, number of cold starts, and number of configurations. It also shows the current temperature on the card together with minimum and maximum temperature during the total operating time.

Thermocouple measurement

Figure 7-13: Thermocouple measurement



The left display field shows the current measuring value as numerical value and as bar diagram. Measuring value of channel 1A is 25.18°C, and the measuring range for the thermocouple is -270°C to +1372°C.

The **Channel OK** object shows a green circle **Sensor A**, which indicates the proper function of the thermocouple. The green circle **Card health** indicates that the card is measuring properly, which means no hardware or software fault has been detected by the internal supervision function and the internal temperature has not exceeded the limit.

The **Limit** display field shows the state of the limit suppression. The solid circle is blue if the limit suppression is active, otherwise the circle is gray.

The **Current suppression** display field shows the state of the current suppression. The solid circle is blue if the current suppression is active, otherwise the circle is gray.

The **Current output** display field shows the current output value.

The **Status values** display field shows the current temperature value together with the measured voltage signal of this thermocouple. The lines below show minimum and maximum values of the temperature and of the voltage levels detected during operation. The display of these values can be a good help on recognition of errors.

Minimum and maximum temperatures are continuously measured during operation and remain displayed until command **Reset min/max values** is given through a digital input or a command in the configuration software.

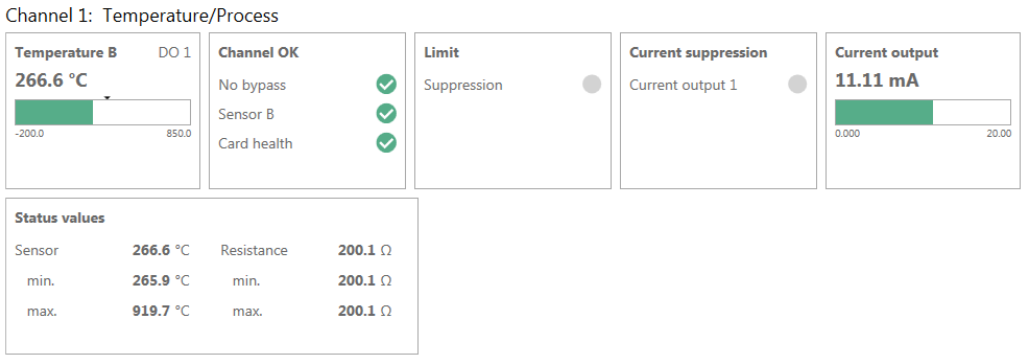
Note

The number of measurement value display field and current output display field depends on the number of configured digital outputs and current outputs for one input channel.

For example, there are two limit values defined for one input signal and so two measurement value display field are shown marked with the assigned digital output (DO1 and DO 2).

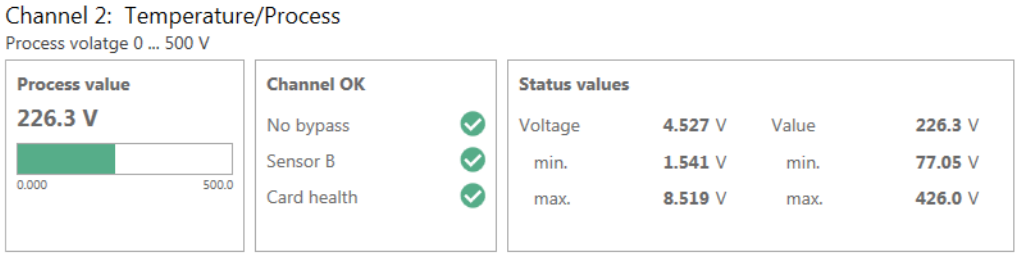
RTD measurement

Figure 7-14: RTD measurement



Process voltage measurement

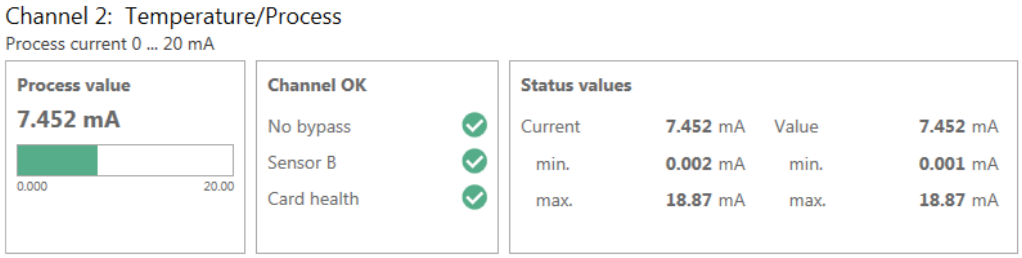
Figure 7-15: Process voltage measurement



Without any configured digital outputs and without current outputs.

Process current measurement

Figure 7-16: Process current measurement

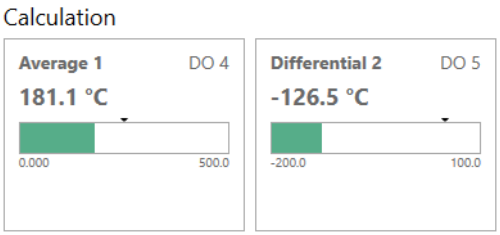


Without any configured digital outputs and without current outputs.

Calculation

The result of the calculation is displayed. Additional graphic objects are added if digital outputs or current outputs are assigned to the calculation result.

Figure 7-17: Calculation



7.3.3 Live data

This display screen shows trend diagrams of all channels simultaneously. For example, see Figure 7-18 with time waveforms of channels 1A and channel 2.

Use the control elements in the upper right corner of each diagram to change the diagram view. Table 7-3 explains the control elements. Right-click somewhere on the diagram to reset the view changes.

Table 7-3: Diagram control elements

Control element	Function
	**Zoom** Use this function to enlarge an interesting part of the diagram. Click the zoom icon to activate the zoom function. The button is colored light blue if zoom is activated otherwise the button is gray. Place the mouse cursor close to the area of interest, left-click and hold. Move the mouse to frame the area of interest. Release the mouse button to enlarge the selected area.
	**Move** Use this function to move the entire view. Click the move icon to activate the function. The button is colored light blue if move is activated, otherwise the button is gray. Left-click an arbitrary point in the diagram and hold. Move the view to the desired position and release the mouse button to place the view at that point.
	**Zoom in** Use this function to stepwise enlarge the diagram view. Click the zoom in icon to activate the function. The button is colored light blue if zoom in is activated otherwise the button is gray. Left-lick an arbitrary point in the diagram view. At every click, the diagram view is enlarged.
	**Zoom out** Use this function to stepwise reduce the diagram view. Click the zoom out icon to activate the function. The button is colored light blue if zoom out is activated otherwise the button is gray. Left-click an arbitrary point in the diagram view. At every click, the diagram view is reduced.

Figure 7-18: Measuring results channels 1A and 2, "Time waveform"

In this diagram, the trends of channels 1A and 2 are visualized as examples. This visualization function shows the trends of all configured channels of this card. Unconfigured or deactivated channels will not appear in this diagram.

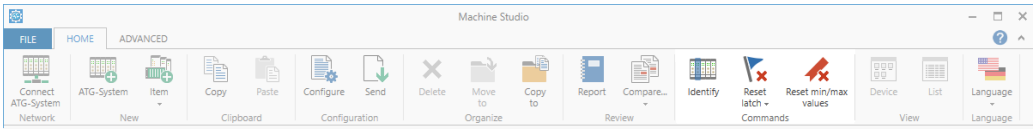
The diagrams show actual measuring results over a time period of 100 seconds. The trend diagrams are only displayed, the results are not saved on hard disk. To store measuring data for later analysis purpose, transmit the data to another computer via Modbus RTU, Modbus TCP/IP, or OPC UA.

7.4 Online commands

The A6500-TP card related commands are described. For description of all other buttons of the ribbon command bar see operating manual "AMS Machine Studio - General Functions "(MHM-97879). Figure 7-19 the ribbon command bar with the marked online commands.

Note
Ensure that there is an online connection to the card before using these commands

Figure 7-19: Command buttons



Identify

Figure 7-20: Button "Identify"

Click **Identify** to identify the card within the rack. This command starts a LED sequence on the front plate of the card. It runs for approximately 15 seconds and stops automatically afterwards.

Reset latch

Figure 7-21: Button "Reset latch"

Click **Reset Latch** to open a selection list with different options for resetting latched alarms:

- **Reset latch 1** to **Rest latch 16**
  Click one of this options to reset latched alarms defined for the respective digital output (digital output 1 to digital output 16).

- **Reset latch all**
  Click this option to reset all latched alarms at once.

Reset min/max values

Figure 7-22: Button "Reset min/max values"

Click **Reset min/max values** to reset of stored minimum or maximum values. This command resets the following status values:

- Minimum measured temperature.
- Maximum measured temperature.
- Minimum measured process values.
- Maximum measured process values.
- Minimum measured input signal.
- Maximum measured input signal.

8 Applications and functions

8.1 Electrical temperature measurement

The measurement of temperature has a great importance in supervising industrial processes. The sensors applied for this measurement define the temperature range, accuracy of the measurement, as well as chemical and physical resistances against environmental conditions at the place of measurement.

This chapter describes temperature measurements with thermocouples and **R**esistance **T**emperature **D**etectors (RTDs) in combination with A6500-TP Temperature Process Cards.

Resistance temperature detectors take advantage of the fact that the resistance of electrical conductors increases with the temperature (PTC resistor). Most popular RTDs are Pt100 resistors, because resistance elements of Platin are precise and have high long-term stability. RTDs for temperature measurements are mainly used for temperatures up to about 600°C. For higher temperatures, thermocouples are used primarily.

8.2 Temperature measurement with RTDs

Resistance elements for temperature measurements with A6500-TP monitors are:

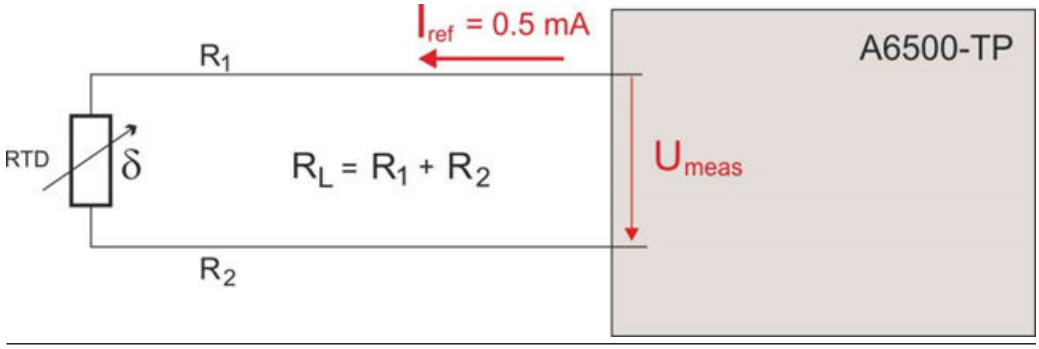
- Pt100, basic resistance 100 Ω / 0°C
- Ni100, basic resistance 100 Ω / 0°C
- Ni120, basic resistance 120 Ω / 0°C
- CU10, basic resistance 10 Ω / 25°C

For temperature measurements, the A6500-TP Temperature Process Card supplies the RTD with an impressed current of 0.5 mA (3-pole connection 0,25 mA). Its resistance is calculated by the measured voltage drop over the RTD. From this value, the program determines the exact temperature value with the help of a linearization table.

Connection types

RTDs can be connected to the A6500-TP card in 2-pole, 3-pole, or 4-pole connection.

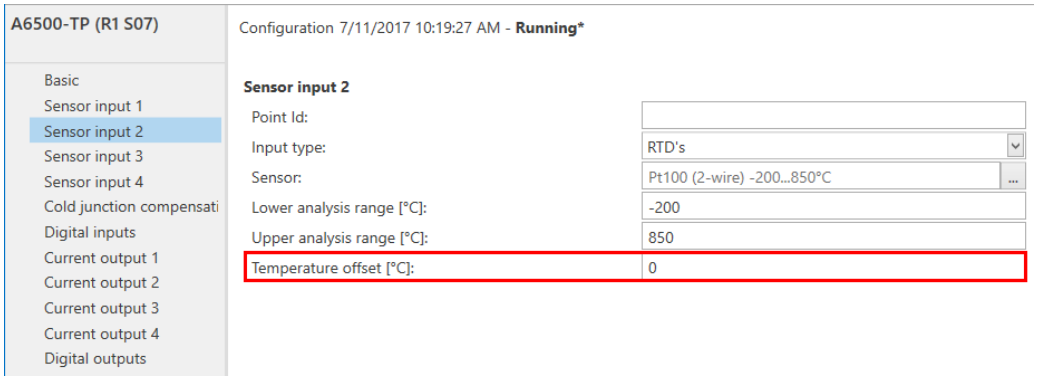
Figure 8-1: 2-pole connection of RTDs



This connection type causes a high error in measurement because the measuring device measures the resistance of the PT100 together with the cable resistance R_L (see Figure 8-1). This means, the indicated temperature is higher than the actual temperature of the Pt100. This measurement error depends on the length of the cable and the environmental temperature of the cable.

To compensate this error, enter an offset value in the configuration parameters in field **Temperature offset [°C]** in the editor **Configuration**.

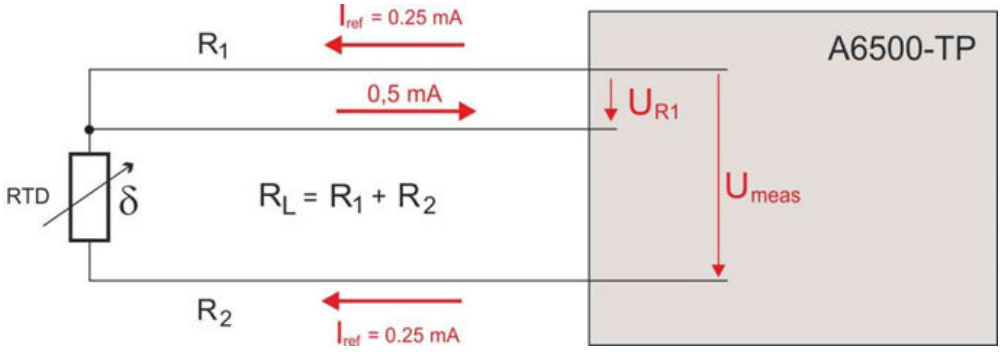
Figure 8-2: Configuration cable compensation RTD measurement



The correction value is calculated by determining the cable resistance and calculating the appropriate temperature deviation with the help of a Pt100 resistance table.

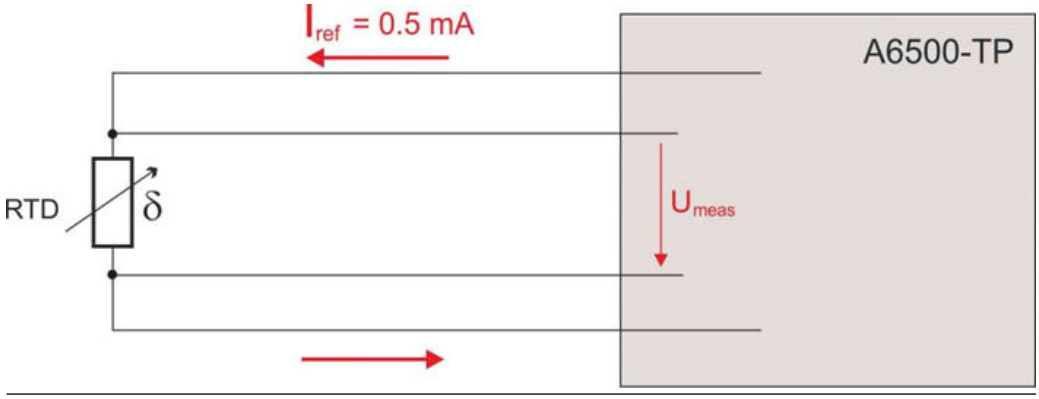
A 3-pole connection is a type of application that is often found in older installations (see Figure 8-3). With this installation, the program compensates the cable resistance automatically by measuring the resistance of one cable core. Since the wires in multicore cables usually have the same resistance, this application measures the correct resistance of the RTD.

Figure 8-3: 3-pole connection of RTDs



A 4-pole connection of RTDs is the most precise way to measure for this application (see Figure 8-4). The voltage drop is measured directly across the Pt100 resistor, regardless of cable type and cable length. The measurement error is reduced to the minimum.

Figure 8-4: 4-pole connection of RTDs



Note
Cold junction compensation with Cu 10 RTDs is only possible with a 4-pole connection mode.
Pt100, Ni100, and Ni120 RTDs for cold junction compensation may be applied in 2-pole, 3-pole, or 4-pole connection mode.

The signal inputs for process signal measurement are electrically isolated from system supply. The correct EMC compliant grounding and shielding of signal cables are described in the operating manual of the A6500-xR System Racks.

8.3 Temperature measurement with thermocouples

Thermocouples consist of two particular metals welded together at one point, called the hot junction point. If this point is exposed to temperatures, one of the metals emits electrons to the other materials. This results in a thermo-voltage of a few millivolts. The higher the temperature, the greater the thermo-voltage between the two metals.

Detection of temperatures with thermocouples are principally punctual contact measurements at the tip of the sensors. The typical scope of application for the use of thermocouples is for temperatures above 600°C. Because of a better accuracy and long-term stability, measurements of temperatures up to this value are usually covered with RTDs.

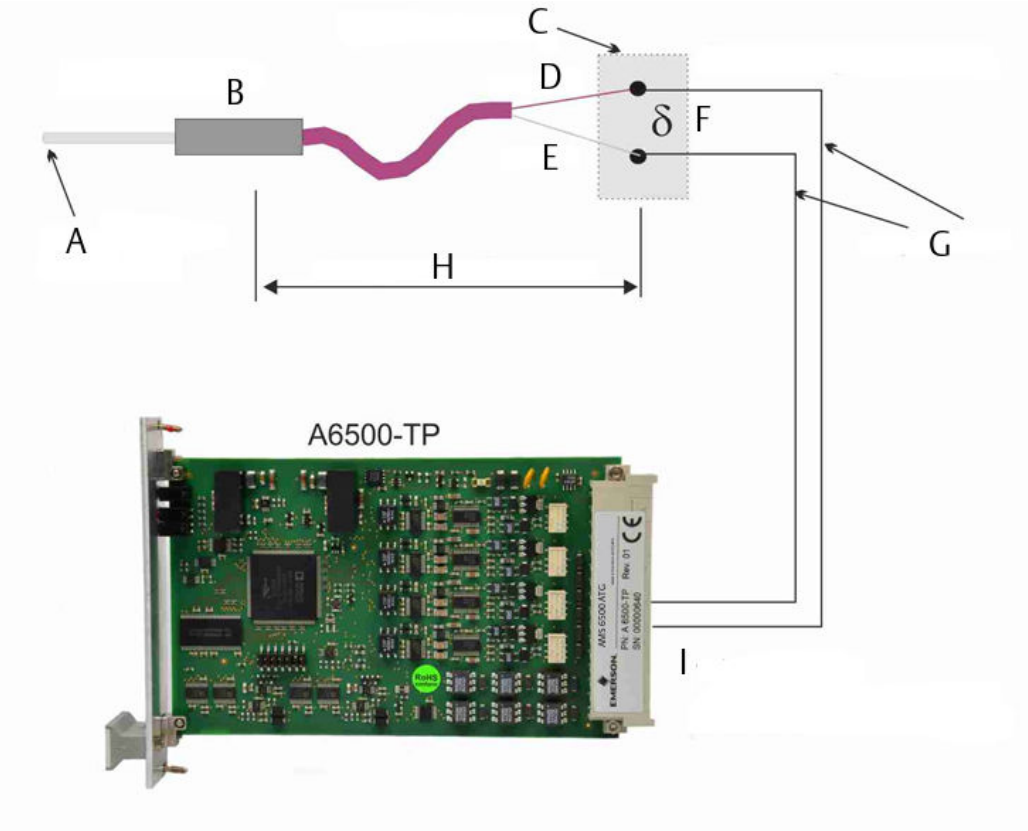
To use the signal of thermocouples for temperature measurement, it must be lead to signal inputs of measuring devices, such as the A6500-TP card. When thermocouples wires are connected to other metals, for example, copper wires, another thermo-voltage arises at this junction point, the cold junction point.

The calculation of the temperature requires only the thermo-voltage of the hot junction point (the tip of the thermocouple). For this reason, the thermo-voltage from the cold junction point must be compensated. This is done by measuring the temperature from this point and compensate this unwanted thermo-voltage.

One method for cold junction compensation is to place the connection point in a closed cabinet or box with a constant temperature, and define this temperature in the configuration software (see Figure 8-5). With this application, any change of the cold

junction temperature will directly influence the measuring result. Details for the input of configuration parameters you can find in Configuration.

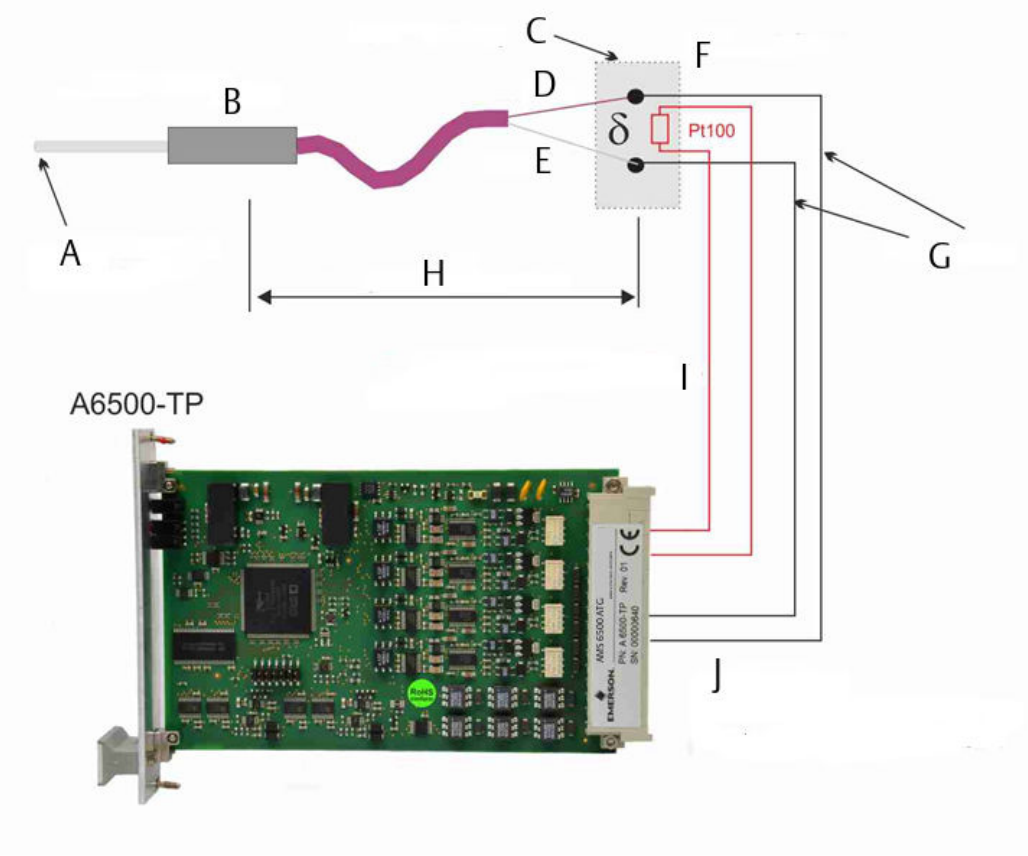
Figure 8-5: Cold junction compensation, constant temperature



A. Hot junction point = measuring point
B. Thermocouple
C. Cold junction point
D. Metal 1
E. Metal 2
F. Constant junction temperature (delta)
G. Copper wires
H. Temperature difference
I. Voltage signal difference of thermo-voltages between metal 1 and metal 2

Another way for the cold junction compensation is the measurement of the temperature inside the terminal box with an RTD, for example, a Pt100 (see Figure 8-6).

Figure 8-6: Cold junction compensation, temperature measured with Pt100



A. Hot junction point = measuring point
B. Thermocouple
C. Cold junction point
D. Metal 1
E. Metal 2
F. Junction temperature (delta)
G. Copper wires
H. Temperature difference
I. Measurement of junction temperature with Pt100
J. Voltage signal difference of thermo-voltages between metal 1 and metal 2

The signal inputs for process signal measurement are electrically isolated from system supply. The correct EMC compliant grounding and shielding of signal cables are described in the operating manual of the A6500-xR System Racks.

Detailed descriptions on the configuration you can find in Configuration.

8.4 Measurement of process parameters

Measurement of process parameters are necessary to supervise and optimize any kind of industrial processes. The A6500-TP Temperature Process Cards were designed to measure the following standard signals:

- 0 to 1 V
- 0 to 10 V
- 0/4 to 20 mA

The measuring results can be visualized, supervised on limit exceeding and via A6500-CC Communication Cards transmitted to analysis systems or host computers for further processing.

During the configuration, the input signals can be scaled, shifted, and output in form of analog signals 0/4 to 20 mA for external indicators or systems.

The signal inputs for process signal measurement are electrically isolated from system supply. The correct EMC compliant grounding and shielding of signal cables are described in the operating manual of the A6500-xR System Racks.

Detailed descriptions on the configuration you can find in Configuration.

8.5 Channel OK supervision

The condition supervision function checks the functionality of card and input signals. This function ensures that invalid measurements are indicated and, if necessary, alarms are deactivated. The indication takes place through:

- The green OK LED on the front plate. The Channel OK supervision of all channels is assigned to the OK LED. The LED is switched off as soon as one channel detects a fault.
- A digital hardware output configured for Channel OK
- Setting of the assigned current output to 0 mA, provided that the current output is configured for the output range of 4 to 20 mA or 20 to 4 mA and the current suppression is activated.
- Modbus and OPC UA interfaces
- Online View of the card in AMS Machine Studio.

Functional disturbances are divided into two groups. Disturbances that affect the monitor are allocated to the group of card errors. Sensor or input signal disturbances are allocated to the group of channel errors.

Card disturbances:

- Firmware errors
- Internal card errors
- Exceeding the temperature danger limit (measured by the internal temperature sensor of the card)

Channel disturbances:

- Sensor errors
- Signal errors

The detection of the sensor status by the Channel OK supervision depends on the connected and configured sensor type. See RTD and Thermocouple and Process signals.

OK LED

Table 8-1: OK LED

Status OK LED	Card based (all channels)			Channel based		
	Description	**Current output 4 to 20 mA[1] and suppression**	**Digital output with Data Source: Channel OK - Combined**	**Description**	**Assigned current output 4 to 20 mA[1] and suppression**	**Digital output with Data Source: Channel OK - Combined**
Off [2]	Card error [3]	0 mA	Depending on configuration, see Table 8-2	Channel error[4]	0 mA	Depending on configuration,see Table 8-2
	Temperature danger [3]	0 mA		Active bypass[4]	0 mA	Depending on configuration,see Table 8-2
Steady light	OK status	No influence		OK status	No influence	Depending on configuration,see Table 8-2
Slow flashing[2]	Normal start phase	0 mA	Off			
	Card not configured	0 mA	Off			
Fast flashing[2]	Temperature alert	No influence	Depending on configuration,see Table 8-2			
	Wait after card error [4]	0 mA	Off			

1 *Or 20 to 4 mA.*
2 *More precise information concerning the cause is available in the Online View.*
3 *Digital outputs are suppressed (initial state of the digital outputs).*
4 *If limit suppression is active, the digital outputs are in their initial state.*

Digital hardware output – Channel OK - Combined

The output state of a digital hardware output with **Data source → Channel OK - Combined** assigned, depends on the configured **Circuit mode**. See Table 8-2

Table 8-2: Output state depending on selected circuit mode

Channel OK state	Circuit mode	Status indication Online View	Digital output state
OK	Normally open	Blue circle	On (24 V)

Table 8-2: Output state depending on selected circuit mode *(continued)*

Channel OK state	Circuit mode	Status indication Online View	Digital output state
	Normally closed	Blue circle	Off (0 V)
Not OK	Normally open	Gray circle	Off (0 V)
	Normally closed	Gray circle	On (24 V)

RTD and Thermocouple

The A6500-TP Temperature Process Card supervises the current flow of the sensor circuit to detect short circuits or open connectors (cable break). A detected sensor error is indicated as described above. The channel error message is reset as soon as the supervised current is in the good range again.

Note
Thermocouples can only be supervised for open connectors (cable break). Short circuit detection is not possible for thermocouples.

When the channel used for the cold junction compensation (CJC) detects a failure, the respective channel and also all of the associated thermocouple channels will turn off Channel OK. Only fully operational channels indicate Channel OK. If more than one Channel OK is missing at the same time, this may be caused by a channel error on the channel used for the CJC sensor.

Process signals

The A6500-TP Temperature Process Card supervises the configured process input signal. If the input signal exceeds the upper limit value (see Table 8-3) or falls below the lower limit value (see Table 8-3), a channel error message is generated. The channel error message is reset as soon as the input signal is in the good range again.

Table 8-3: Process signals – Channel OK limits

Analysis range	Channel OK limit	
	Lower	Upper
0 to 1 V	-0.1 V	1.1 V
0 to 10 V	-0.1 V	10.1 V
0 - 20 mA	-0.2 mA	21.0 mA
4 - 20 mA	3.6 mA	21.0 mA

8.6 Bypass

The four input channels of the A6500-TP card can be bypassed channel by channel. Different interfaces are available to activate a bypass:

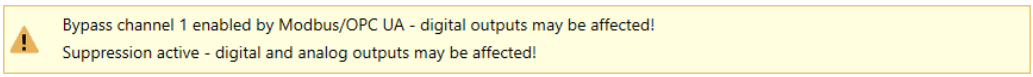
1. Digital inputs (see Digital inputs)
2. Software inputs (Modbus and OPC UA), see Digital inputs

⚠ DANGER

Bypassed inputs channels are not part of the machine protection.

The source of the bypass activation is displayed in the online view of AMS Machine Studio, if the bypassed card is selected.

Figure 8-7: Active bypass notification



With an activated bypass the related input channel is switched off and assigned outputs are switched to their initial state. The initial state depends on the configured operating principle (normally open- or normally closed-circuit mode) of the digital outputs.

Whether the Channel OK output (digital output with **Data source** set to **Channel OK - Combined**) is affected or not depends on the configuration of the parameter **Bypass affects Channel OK**. See Digital outputs.

The alarm states provided through the Modbus or OPC UA interface are also affected by the bypass. The online display of the measuring value is grayed out but still indicating the current value. An active bypass is indicated by:

- Modbus registers and OPC UA data points
- Online display
- Digital output with **Data source** → **Channel OK - Combined**
  If **Bypass affects Channel OK** is activated.
- Channel OK
  All functions and display elements related to Channel OK react accordingly, see Table 8-1.

9 Replace a Temperature Process Card

Follow the steps listed below if a A6500-TP Temperature Process Card needs to be replaced, for example, due to a defect.

Procedure

1. **⚠ CAUTION**

   Any work at the system may impair machine protection.

   Save the card configuration – if possible.
   a) Connect the configuration device (PC/Laptop) through USB or Ethernet connection to the A6500-CC Com Card.
   b) Start AMS Machine Studio. If connected through USB, the software automatically connects to the AMS 6500 ATG rack and opens the rack view. If connected through Ethernet, click **Connect ATG-System** to establish the connection.
   c) Double-click the card to be replaced. The online view of the card opens.
   d) Click **Configure** to open the configuration of the card.
   e) Save the configuration file. Go to **File** and select **Save as**.
   f) Go back to the editor and close it.
   Do not close AMS Machine Studio.

2. At the System Rack, unfasten both screws at the front plate of the card to be replaced (see Figure 2).
3. Remove the card from the slot.
4. Install the new card.
5. Fasten the screws at the front plate to secure the card in the slot.
   The card will be automatically detected by AMS Machine Studio if the System Rack is still powered.
6. Load the configuration from the memory of the configuration device into the card. If, due to a defect, there was no possibility of reading the configuration from the card to be replaced, use a back-up configuration file or create a new configuration.
   a) Select the replaced card in the rack view. Double-click the new card to open the Online View.
   b) Click **Configure** to open the configuration of the card.
   c) Open the saved configuration file. Go to "**File**" and select **Open**.
   d) Click **Send & close** to load to configuration to the new card.
   After a successful sending of the configuration the editor automatically closes.

   Now, the new card is ready for operation.

10 Functional check and maintenance

10.1 Functional check

This chapter provides guidance during installation or in case of misfunction during the operation of the system.

⚠ CAUTION

Any work a the system may impair machine protection.

10.1.1 Check of the measuring functions

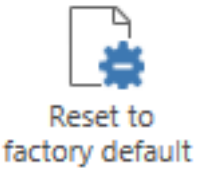
After installation and configuration check the function of the entire system. A complete functional check includes:

- Check of correct polarity of sensors and cable connectivity. This includes checking all signal paths from the sensors to the card inputs.
- Examine actual measurement indications on exceeding of measuring ranges.
- Read the output indications and examine the correct scaling.
- Check the correct wiring at the terminal blocks. Different measuring functions require individual connections at the input connectors.
- Check the configuration and that the parameters were loaded to the cards. When the configuration is finished, save the configuration files on hard disk.
- Check the signal quality at the input terminals with respect to interferences. This applies especially in case of unstable measuring indications and for measurements with thermocouples. Signals of these sensors are very low, disturbances on the signal lines may lead to unstable indications or even to unwanted triggering of alarms.

In some cases it may be useful, to open display screen **Details** to get detailed information about the measurement.

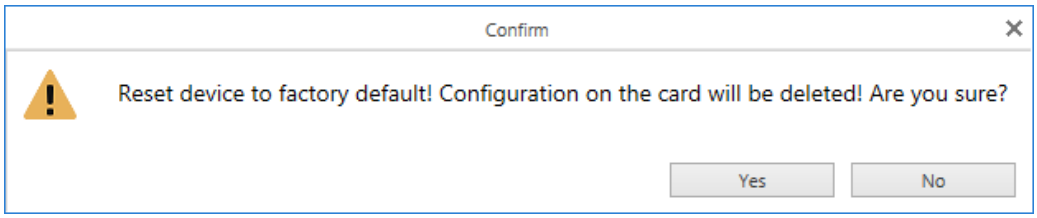
If a problem still exists, Emerson recommends resetting the system and enter parameters anew. Click the card in question in the tree structure, and then select the icon **Reset to factory default** (see Figure 10-1).

Figure 10-1: Reset to factory default



AMS Machine Studio displays the following warning message (seeFigure 10-2).

Figure 10-2: Warning message factory default reset



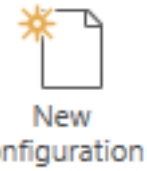
By confirming with yes, the configuration parameters will be erased and reset on factory default state. To continue operation, enter new parameters.

Click the **Configure** icon (see Figure 10-3).

Figure 10-3: Configure

When the program has changed to application window **Card Configuration**, click **New configuration** (see Figure 10-4) to create a new parameter set and enter new parameters.

Figure 10-4: New



10.1.2 Check of thermocouple measurements

Check the configuration of the channel and that the parameter set was loaded to the protection card. Open the online indication with the measuring results, and check whether the temperature value is within the expected range compared to indications of other devices.

If the indicated temperature is too low or too high, this could be caused by a wrong linearization due to a wrong thermocouple type. Another reason could be a faulty polarization of the thermocouple, a wrong compensating line, or a wrong temperature for the cold junction point.

Measure the thermocouple signal at the input connectors or read the signal level in the online display of the configuration software, application window **Details** - display field **Status values**. This field shows the signal level of the thermocouple [mV], which can be used for the functional check.

Compare signal level of the thermocouple and environmental temperature with a temperature table of the thermocouple.

- If the input signal shows any kind of interference, to check the correct cable shielding to ensure a correct measurement.
- Check the cold junction temperature and the correct configuration of this parameter. If the cold junction temperature is measured with an RTD, check the correct wiring and the correct configuration of this sensor.
  Compensating lines of materials that do not match to the thermocouple type, causes the formation of another two unwanted thermocouples, and thus a corruption of the measuring signal. Thermocouples and compensating cables have to be of same material in any case.
- If the input terminals show a signal level, much higher than the normal signal range of the sensor, this might be caused by a broken thermocouple. Measure the resistance of the sensor with an ohmmeter between the input terminals. With an intact thermocouple, you should measure a very low resistance of between 0,2 Ω to approximately 5 Ω per meter cable length, depending on the sensor type.
  If you measure a resistance of more than about 500 Ω, the thermocouple is broken and must be replaced.

10.1.3 Check of RTD measurements

Disconnect the RTD sensor from the A6500-TP channel to be tested and measure the resistance of the RTD with an ohmmeter.

Use Table 10-1 for a rough test of the RTDs by means of the measured resistance.

Table 10-1: Table of RTD resistance values

Sensor type	0°C	10°C	20°C	30°C	40°C
Pt100	100.00 Ω	103.90 Ω	107.79 Ω	111.67 Ω	115.54 Ω
Ni100	100.00 Ω	105.60 Ω	111.30 Ω	117.10 Ω	123.00 Ω
Ni120	120.00 Ω	124.68 Ω	129.35 Ω	134.00 Ω	138.65 Ω
Cu10	9.04 Ω	9.42 Ω	9.81 Ω	10.19 Ω	10.58 Ω

Reconnect the RTD and compare the measured resistance with the displayed resistance (application window **Details**, display field **Status values**). Both values must be identical as close as possible.

If the difference between measured resistance at, for example, 20°C and the values in the table above exceeds the permissible limit with respect to the equipment accuracy, the sensor must be replaced.

10.1.4 Check of process value measurements

The connection of process values to the A6500-TP card is made to terminal pins different to the connection of RTDs and thermocouples. If the measurement is not running properly, first check the correct connection.

The measured input signal can be read in the online display of the configuration software, application window **Details** - display field **Status values**. This field shows signal level [V] together with the scaled process values and their min/max values.

In case of problems, these indications shows, whether the problem is located in the measuring system or if it is coming from the connected external device. The voltage level in the left column of display field **Status values** has to be identical with the signal at the terminal pins. If not, the measuring circuit on the protection card is not working properly and has to be replaced.

10.2 Maintenance

The A6500-TP Temperature Process Card does not require any maintenance during normal operation.

11 Technical data

Only specifications with indicated tolerances or limit values are obligatory. Data without tolerances or without error limits are informative data and not guaranteed. Technical modification, especially of the software, are subject to changes without notice. If not specified otherwise, all data are referred to an environmental temperature of +25°C.

11.1 Power supply

Nominal voltage	+24 V	redundant supply voltage inputs protected against polarity reversal
Permissible voltage range	+19 V to +32 V DC	in case of a single failure, supply voltage must not exceed the level of IEC 60204-1 or IEC 61131-2 (SELV/PELV)
Overvoltage protection	>+33 V DC	card shuts down at overvoltage condition
Power consumption	5 W	Test condition: all current outputs at full load, all outputs active (exterior load currents of digital outputs must be considered separately)

11.2 Signal input

Sensor and process signal input		
Number of temperature sensor inputs	8	independently configurable for different temperature sensors or process signal inputs nonreactive short circuit proof
Number of process signal inputs	4	
Input resolution	24 bit ADC	
Input isolation		the four inputs are galvanically isolated against each other based on levels of IEC 60204-1 respectively IEC 61131-2
Signal input	0 to 11 V	Process input
	0 to 20 mA	
	resistance temperature sensor / thermometer	RTD / thermocouple input
Rated voltage at current input	2.4 V	
Rated power at current input	50 mW	

Sensor and process signal input		
Rated voltage at voltage input	0.11 mA	
Rated power at voltage input	1.2 mW	

Process input voltage		
Range	0 to 10 V	
Accuracy	±1% of full scale	
Impedance	>100 kΩ	
Temperature drift	±0.5% of full scale	within operating temperature range of -20°C to +70°C

Process input current		
Range	0/4 to 20 mA	current limiter
Accuracy	±1% of full scale	
Impedance	<200 Ω	
Temperature drift	±0.5% of full scale	within operating temperature range of -20°C to +70°C

RTD sensor input		
Type	Pt100, Ni100, Ni120, Cu10	Pt100 (α =0.00385) Ni100 (α =0.00618) Ni120 (α =0.00672) Cu10 (α =0.00427)
Technology	2-, 3-, and 4-wire	Cu10 is not applicable in 2-wire and 3-wire technology
Accuracy	±1 K	
Excitation current	500 µA	for 3-wire 2 x 250 µA
Cable resistance	<120 Ω	per wire and if ex-application, including possible safety barrier impedance
Temperature drift	±1 K	within operating temperature range of -20°C to +70°C

Thermocouple input		
Type	E, J, K, N, T	
Accuracy	±1 K	
Cold junction compensation	exterior	use RTD sensor input for cold junction compensation (CJC)
Capacity	<10 µF	including sensor cable

Thermocouple input		
Temperature drift	±1 K	within operating temperature range of -20°C to +70°C

11.3 Digital input

Number of inputs	2	
Logic low level	0 to 3 V	active
Logic high level	13 to 32 V, open	not active
Load	<1 mA	
Rated current	1 mA	
Rated power	24 mW	

11.4 Outputs

Current output		
Number of outputs	4	
Range	0/4 to 20 mA	
Accuracy	±1% of full scale	
Load	<500 Ω	
Rated voltage	10 V	
Rated power	0.2 W	
Temperature drift	±1% of full scale	within operating temperature range of -20°C to +70°C

Digital output		
Number of outputs	6	
Type	normally open	equivalent to SPST protected against polarity reversal
Voltage capability	19 V to 32 V DC	
Maximum load	100 mA	
Rated current	100 mA	
Rated power	2.4 W	
Turn-on/turn-off time	<5 ms	at 20kΩ load (without alarm detection timeas configured delays, filter set-tings, and so on)

11.5 Data interface

Communication bus	RS 485	according EIA485 standard
Bus termination	exterior	bus termination according to EIA485 can be provided externally

11.6 Mechanical design and environmental conditions

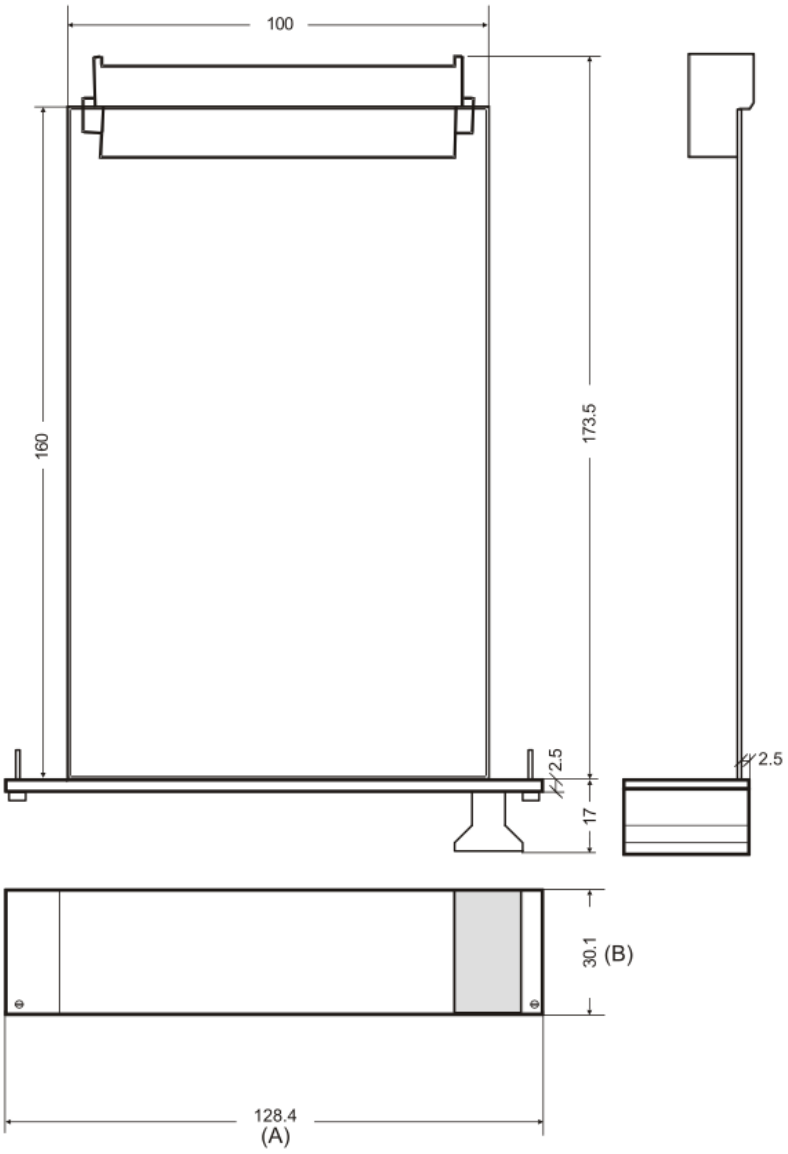
Mechanical design		
Rack slot	3RU/6HP	
Material front panel	aluminum, clear anodized	
Board dimensions	100x160 mm	euro-card format conform to IEC 60297
Board coating	Airborne contaminants resistance	ISA-S71.04-1985 airborne contaminants class G3, Conformal Coating
	Material: HumiSeal® 1B31 EPA	according to IPC-CC-830B and IPC-A 610
Card connector	type F48 male	according to IEC 60603-2
Status indication	LED (3 mm)	one green OK LEDs and four red Alarm LEDs at front panel
Weight	approximately 200 g	without packaging
Overall dimensions		see Figure 11-1

Environmental conditions		
Protection class	IP20	according to IEC 60529 rack mounted, otherwise IP00
Approval class for general safety	Class 2253 01	industrial automation products
	Class 2253 81	industrial automation products - (certified to U.S. standards)
Allowed degree of pollution	Category 2	according to IEC 61010-1
Operating temperature	-20°C to +70°C	with forced cooling[1]
	-20°C to +55°C	without forced cooling
Storage temperature	-40°C to +85°C	
Relative humidity	5 to 95%	noncondensing
Shock	150 m/s^2	according to IEC 60068-2-27, 4000 shocks per axis

Environmental conditions		
Vibration	0.15 mm 20 m/s²	10 to 55 Hz 55 to150 Hz according to IEC 60068-2-6, float sinus, three axis
Operating altitude	<2000 m	above see level
Environmental area	Indoor use only	
External devices		in case of a single failure, externally connected devices must not exceed the level of IEC60204-1 or IEC 61131-2

1 An airflow of ≥440 m^3/h is required.

Figure 11-1: Dimensions



A. 3 RU
B. 6 HP

All dimensions in mm

12 Certificates

CE

EMERSON

EU-Declaration of Conformity (Translation)

We: epro GmbH, Jöbkesweg 3, 48599 Gronau

declare under our sole responsibility that following product(s):

Product designation:	**AMS 6500 ATG**
Product description:	**Protection system for rotating equipment with integrated prediction capabilities**
Part numbers	**A6500-CC** **A6500-UM** **A6500-TP** **A6500-RC** **A6500-SR** **A6500-RR** **A6500-FR**

are in conformity with the terms of the directives mentioned below including any amendment valid at the date of declaration:

2014/30/EU	Electromagnetic compatibility
2014/34/EU	Equipment and protective system intended for use in potentially explosive atmospheres
2011/65/EU	The restriction of the use of certain hazardous substances in electrical and electronic equipment

Following harmonized standards have been applied:

2014/30/EU	EN 61326-1	Electrical equipment for measurement, control and laboratory use. EMC requirements. Part 1. General requirements
2014/34/EU	EN 60079-0	Explosive atmospheres - Part 0: Equipment - General requirements
	EN 60079-7	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
2011/65/EU	EN 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

For the type examination according to EN 60079-0 and EN 60079-7 the following notified body has been involved;

DEKRA EXAM GmbH
Type examination certificate BVS 16 ATEX E 016 U

Authorized person for technical documentation:

Bruno Hecker, Jöbkesweg 3, 48599 Gronau

Gronau, 06 May 2022
Place, Date

Managing Director

Quality

CE

EMERSON

EU-Konformitätsserklärung (Original)

Wir: epro GmbH, Jöbkesweg 3, 48599 Gronau

erklären in alleiniger Verantwortung, dass folgende Produkte:

Produktbezeichnung:	**AMS 6500 ATG**
Produktbeschreibung:	**Schutzsystem für rotierende Maschinen mit integrierten Diagnosemöglichkeiten**
Artikelnummern:	**A6500-CC** **A6500-UM** **A6500-TP** **A6500-RC** **A6500-SR** **A6500-RR** **A6500-FR**

den Bestimmungen der unten genannten Richtlinien, einschließlich deren zum Zeitpunkt der Erklärung geltenden Änderungen, entsprechen:

2014/30/EU	Elektromagnetische Verträglichkeit
2014/34/EU	Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen
2011/65/EU	Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten

Folgende harmonisierte Normen wurden angewandt:

2014/30/EU	EN 61326-1	Elektrische Mess-, Steuer-, Regel- und Laborgeräte – EMV Anforderungen - Teil 1: Allgemeine Anforderungen
2014/34/EU	EN 60079-0	Explosionsgefährdete Bereiche - Teil 0: Betriebsmittel – Allgemeine Anforderungen
	EN 60079-7	Explosionsgefährdete Bereiche - Teil 7: Geräteschutz durch erhöhte Sicherheit "e"
2011/65/EU	EN 63000	Technische Dokumentation zur Beurteilung von Elektro- und Elektronikgeräten hinsichtlich der Beschränkung gefährlicher Stoffe

Für die Baumusterprüfung nach EN 60079-0 und EN 60079-7 ist folgende Benannte Stelle eingeschaltet worden:

DEKRA EXAM GmbH
Baumusterprüfnummer BVS 16 ATEX E 016 U

Bevollmächtigter für die Technische Dokumentation:

Bruno Hecker, Jöbkesweg 3, 48599 Gronau

Gronau, 06. Mai 2022
Ort, Datum

Geschäftsführung

B. Hecker
Qualitätsmanagement

UK CA

EMERSON

UKCA-Declaration of Conformity

We, the manufacturer: epro GmbH, Jöbkesweg 3, 48599 Gronau, Germany

declare under our sole responsibility that following product(s):

Product designation:	**AMS 6500 ATG**
Product description:	**Protection system for rotating equipment with integrated prediction capabilities**
Part numbers	**A6500-CC** **A6500-UM** **A6500-TP** **A6500-RC** **A6500-SR** **A6500-RR** **A6500-FR**

are in conformity with the terms of the directives mentioned below including any amendment valid at the date of declaration:

S.I. 2016 No. 1091	Electromagnetic Compatibility Regulations 2016
S.I. 2016 No. 1107	Equipment and Protective Systems Intended for use in Potentially Explosive Atmospheres Regulations 2016
S.I. 2012 No. 3032	The restriction of the use of certain hazardous substances in electrical and electronic equipment

Following standards have been applied:

S.I. 2016 No. 1091	EN 61326-1	Electrical equipment for measurement, control and laboratory use. EMC requirements. Part 1. General requirements
S.I. 2016 No. 1107	EN 60079-0	Explosive atmospheres -Part 0: Equipment- General requirements
	EN 60079-7	Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
S.I. 2012 No. 3032	EN IEC 63000	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

For the type examination according to EN 60079-0 and EN 60079-7 the following notified body has been involved:

DEKRA Testing and Certification GmbH

Type examination certificate BVS 16 ATEX E 016 X

Authorized person for technical documentation:

Bruno Hecker, Jöbkesweg 3, 48599 Gronau, Germany

Authorized Representative:

Emerson Process Management Limited,
company No 00671801
Meridian East,
Leicester
LE19 1UX, United Kingdom
Regulatory Compliance Department
email:*ukproductcompliance@emerson.com*
Phone: +44 11 6282 23 64

M. Fränzer
Managing Director

B. Hecker
Quality

Place, Date: Gronau, 13 September 2022

Emerson Process Management
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product – A6500-UM

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements
表1： 有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	**汞** Mercury (Hg)	**镉** Cadmium (Cd)	**六价铬** Hexavalent Chromium (Cr (VI))	**多溴联苯** Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
面板 FACEPLATE	O	O	O	O	O	O	
印刷电路板组装支持 PC BD ASSY SUPPORT	O	O	O	O	O	O	
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
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James McFerrin
Environmental Compliance Manager PSG
T 512 832 3271 E james.mcferrin@emerson.com

EMERSON
Process Management

Emerson Process Management
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product – A6500-TP

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印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
面板 FACEPLATE	O	O	O	O	O	O	
印刷电路板组装支持 PC BD ASSY SUPPORT	O	O	O	O	O	O	
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James McFerrin
Environmental Compliance Manager PSG
T 512 832 3271 E james.mcferrin@emerson.com

EMERSON
Process Management

Emerson Process Management
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product – A6500-RC

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements
表1： 有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	**汞** Mercury (Hg)	**镉** Cadmium (Cd)	**六价铬** Hexavalent Chromium (Cr (VI))	**多溴联苯** Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
面板 FACEPLATE	O	O	O	O	O	O	
印刷电路板组装支持 PC BD ASSY SUPPORT	O	O	O	O	O	O	
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
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James McFerrin
Environmental Compliance Manager PSG
T 512 832 3271 E james.mcferrin@emerson.com

Emerson Process Management
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product – A6500-CC

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements
表1： 有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
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印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
面板 FACEPLATE	O	O	O	O	O	O	
印刷电路板组装支持 PC BD ASSY SUPPORT	O	O	O	O	O	O	
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
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James McFerrin
Environmental Compliance Manager PSG
T 512 832 3271 E james.mcferrin@emerson.com

Emerson Process Management
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product – A6500-SR

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements
表1： 有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	**汞** Mercury (Hg)	**镉** Cadmium (Cd)	**六价铬** Hexavalent Chromium (Cr (VI))	**多溴联苯** Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
围墙 ENCLOSURE	O	O	O	O	O	O	
硬件 HARDWARE	O	O	O	O	O	O	
印刷电路板组装支持 PC BD ASSY SUPPORT	O	O	O	O	O	O	
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
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James McFerrin
Environmental Compliance Manager PSG
T 512 832 3271 E james.mcferrin@emerson.com

EMERSON
Process Management

Emerson Process Management
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product – A6500-RR

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Table 1: Names and Contents of Toxic or Hazardous Substances or Elements
表1： 有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	**汞** Mercury (Hg)	**镉** Cadmium (Cd)	**六价铬** Hexavalent Chromium (Cr (VI))	**多溴联苯** Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
围墙 ENCLOSURE	O	O	O	O	O	O	
硬件 HARDWARE	O	O	O	O	O	O	
印刷电路板组装支持 PC BD ASSY SUPPORT	O	O	O	O	O	O	
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
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James McFerrin
Environmental Compliance Manager PSG
T 512 832 3271 E james.mcferrin@emerson.com

Emerson Automation Solutions
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product - A6500-FR

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements
表1： **有毒有害物**质或元素的名称及含量

部件名称 Part Name	**有毒有害物质或元素** Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	**汞** Mercury (Hg)	**镉** Cadmium (Cd)	**六价铬** Hexavalent Chromium (Cr (VI))	**多溴联苯** Polybrominated biphenyls (PBB)	**多溴二苯醚** Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
硬件 HARDWARE	O	O	O	O	O	O	
O **表示**该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
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James McFerrin
Environmental Compliance Manager
Systems and Solutions
T 512 832 3271 E james.mcferrin@emerson.com

Emerson Automation Solutions
1100 W. Louis Henna Blvd.
Round Rock, TX 78681

Statement Regarding the China RoHS Compliance of Emerson Product - A6500-PE

Please refer to Table 1 for the names and contents of the toxic or hazardous substances or elements contained in Emerson products.

Table 1: Names and Contents of Toxic or Hazardous Substances or Elements
表1： 有毒有害物质或元素的名称及含量

部件名称 Part Name	有毒有害物质或元素 Toxic or hazardous Substances and Elements						
	铅 Lead (Pb)	汞 Mercury (Hg)	镉 Cadmium (Cd)	六价铬 Hexavalent Chromium (Cr (VI))	多溴联苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyl ethers (PBDE)	
印刷电路板组装 C PC BD ASSY C	X	O	O	O	O	O	
印刷电路板组装 PC BD ASSY	X	O	O	O	O	O	
硬件 HARDWARE	O	O	O	O	O	O	
O 表示该有毒有害物质在该部件所有均质材料中的含量均在GB/T 26572规定的限量要求以下 O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in GB/T 26572.							
X 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出GB/T 26572规定的限量要求。 X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement in GB/T 26572							
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James McFerrin
Environmental Compliance Manager
Systems and Solutions
T 512 832 3271 E james.mcferrin@emerson.com

A Card related system events

The possible system events provided by the A6500-TP card are listed in Table A-1. See column **Cross reference / Note** for further event related information. See Machine Studio – General Functions manual for a common description of the system events.

Table A-1: Card events

Event	Cross reference / Note
Alarm entered	Digital outputs
Alarm left	
Channel OK entered	Channel OK supervision
Channel OK left	
Digital output x[1] on (Hardware)	Digital outputs
Digital output x[1] off (Hardware)	
Digital output y[2] on (Software)	
Digital output y[2] off (Software)	
Sensor OK left	Channel OK supervision
Sensor OK entered	
Temperature danger alarm entered	Channel OK supervision, see Overview for alarm indication
Temperature danger alarm left	
Temperature alert alarm entered	
Temperature alert alarm left	
Card starts up	-/-
Card started up successfully	-/-
Warm start finished	Software initialized start of the card is completed
Card reboots	-/-
Card configuration error	-/-
Bus address assigned successfully	Automatically assigned bus address for communication with A6500-CC card.
Bus address assigned failed	
Connection to A6500-CC established	-/-
Connection to A6500-CC lost	-/-
Mismatched checksum detected (package re-sent)	If the event appears only once, then resending solved the issue. If the event appears more often, contact support, see Technical support.
Card configured and rebooted	Send a configuration

Table A-1: Card events *(continued)*

Event	Cross reference / Note
Card configured	
Reset min/max entered	Online commands
Reset min/max left	
EEPROM error	Replace the card, if this does not solve the problem, contact support, see Technical support.
ADC error	
Reset Latch DO x[3] entered	Digital inputs, Online commands
Reset Latch DO x[3] left	
Bypass CH x[4] activated	Bypass
Bypass CH x[4] deactivated	

1 *x = 1 to 6*
2 *y = 7 to 16*
3 *x = 1 to 16*
4 *x = 1 to 4*

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MHM-97874
Rev. 5.06
2024

Emerson
12001 Technology Drive
Eden Prairie, MN 55344 USA
T 1(952)828-3000
www.Emerson.com

Emerson
835 Innovation Drive
Knoxville, TN 37932 USA
T +1 865-675-2400
F +1 865-218-1401
www.Emerson.com

Emerson
Jöbkesweg 3
48599 Gronau
Germany
T +49 2562 709 0
F +49 2562 709 401
www.Emerson.com/ams

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