Process Solutions

Honeywell

Technical Information

# Experion Series C Turbomachinery I/O Specification

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## Revision History

| Revision | Date | Description |
|---|---|---|
| 1.0 | October 2019 | Experion Series C Turbomachinery I/O Specification |

## Table of Contents

# 1. Product Introduction Summary

## 1.1. Overview

This document provides technical information to configure the Experion® Series C Turbomachinery Platform and I/O released with Experion R511.

## 1.2. Scope

The following Series C Turbomachinery I/O modules are included in this document.

- CC-PSV201 - Servo Valve Positioner Module (SVPM), 2 valves
- CC-TSV201 - Servo Valve Positioner IOTA redundant 2 valves
- CC-PSP401 - Speed Protection Module (SPM), 4 channels
- CC-TSP-401 - Speed Protection IOTA redundant 4 channels

## 1.3. Definitions

- **Input/Output Termination Assembly (IOTA):** An assembly that holds the IOM and connections for field wiring.
- **Input/Output Module (IOM):** A device that contains most of the electronics required to perform a specific I/O function. The IOM plugs onto the IOTA.
- **Linear/Rotational Variable Differential Transformer (LVDT/ RVDT):** A transducer used for linear/rotational position measurement. It is typically used for measuring position feedback of actuators used in turbomachinery control applications.
- **Servo Valve/ Servo Motor:** It accepts an electrical control signal and converts it to a proportional hydraulic signal. Used for operating hydraulic actuators used in turbomachinery control.

# 2. Features

All Series C components feature an innovative design that supports enhanced heat management. This unique look provides a significant reduction in overall size for the equivalent function.

The unique features of Series C I/O include:

- I/O Module and field terminations are combined in the same area. The I/O Module is plugged into the IOTA to eliminate the need for a separate chassis to hold the electronics assemblies.
- Two level "detachable" terminals for landing the field wiring in the enclosure, providing easier plant installation and maintenance.
- Field power is supplied through the IOTA, with no need for extra power supplies and the associated craft wired marshalling.
- Redundancy is accomplished directly on the IOTA without any external cabling or redundancy control devices by simply adding a second IOM to an IOTA.

The Series C innovative styling includes unique features to facilitate the effective use of control hardware in a systems environment:

- Vertical mounting allows for more effective wiring since most field wiring applications require entry from the top or bottom of the systems cabinet.
- An "information circle" allows for a quick visual cue to draw the maintenance technician’s eye to important status information.
- "Tilted" design allows for effective heat management within the cabinet enclosure. Since Series C allows for a significant increase in cabinet density, an effective heat management system is critical for high systems availability.
- Input and output circuits are protected from shorts to alleviate the need for in-line fusing, reducing installation and maintenance costs.

Series C IOTAs combine multiple functions into a single piece of equipment:

- Single and redundant configurations (R400 supports only redundant configuration)
- On-board termination of process signals
- On-board signal conditioning

- On-board connection to appropriate networks (FTE, I/O LINK)
- Field power distribution without external marshalling
- IOM plugs into the IOTA and receives power from it
- The IOTA receives its power from a 24 VDC bus that is part of the IOTA carrier – the IOTA is simply screwed into the bussed power.

# 3. Series C I/O Sizing

In virtually all configurations, the C300 controller and Series C I/O provide useful, maintainable process equipment connections in a footprint smaller than existing competitors and Honeywell-equivalent products. Installing Series C I/O modules contributes to overall total installed cost savings.

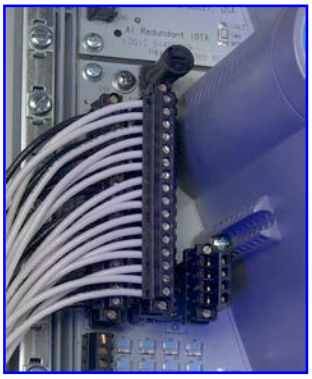
SVPM and SPM modules reside on an 18--inch IOTA in a redundant configuration.

## 3.1. I/O Module Functions

- **SVPM (2 valves)** – Provides two AI, two LVDT interfaces, two Servo interfaces, two AO interfaces and two DI interfaces. AI and LVDT are mutually exclusive. Similarly Servo and AO are also mutually exclusive.

- **SPM (4 channel)** – Provides eight AI, eight DI interfaces, four DO interfaces, four active/passive probe interfaces and one AO interface.

# 4. Series C Field Connections



Series C field connections use a standard modular connector. The connector modularity allows for removal and insertion of the field wiring. This significantly reduces installation and maintenance procedures and can assist in field check out.

Series C field connectors accept up to 12ga AWG/2.5 mm stranded wire.

A mass termination cable (also known as the bulk cable) is available to support marshalling applications. Mass termination eliminates individual wiring to Series-C field connections. Series-C I/O installations do not require separate marshalling. However, when marshalling is desired, the mass termination cable provides an easy and efficient connection from the I/O to the marshalling cabinet. Mass termination also supports other atypical wiring needs. Cables can be ordered from various Honeywell partners. Contact your local account manager for specific partner information.

IOTA sizing is nominal (6 in = 152 mm, 9 in = 228 mm, 12 in = 304 mm, 18 in = 457 mm).

I/O modules are associated with their respective IOTAs in the table below. The I/O module is supported by one or more IOTAs.

# 5. I/O Module Sizes

| I/O Module | IOTA | Description | Circuits | Size | Red. |
|---|---|---|---|---|---|
| CC-PSV201 | | Servo Valve Positioner, 2 valves (SVPM IOM) | 2 | | |
| | CC-TSV211 | Servo Valve Positioner IOTA Red, 2 valves (SVPM IOTA) | | 18 | √ |
| CC-PSP401 | | Speed Protection, 4 channels (SPM IOM) | 4 | | |
| | CC-TSP411 | Speed Protection IOTA Red, 4 channels (SPM IOTA) | | 18 | √ |

# 6. Specifications

Specifications for the various Series C Turbomachinery I/O modules are given below.

**For information on environmental specifications, please refer to the Series C Turbomachinery IO Platform Specification and Technical Data Sheet EP03-540-400.**

# 7. Servo Valve Positioner Module (SVPM) – CC-PSV201

## 7.1. Function

This Series C I/O module provides an onboard PID positioning loop for positioning a servo valve typically used in a turbomachinery control application. It can accept LVDT/RVDT/4-20 mA position feed back signals from the control valve, receive a control valve demand remote set point from a C300-20msCEE controller and execute onboard PID positioning loop to issue current output to servo valve coil to control the control valve position.

## 7.2. Notable Features

- Onboard PID positioning loop execution with overall loop latency within 10 mS
- Onboard excitation supply for LVDT and support for various configurations of LVDT connections
- LVDT input channel can be optionally configured to accept 4-20 mA analog input signal
- Supports wide range of unidirectional/bidirectional current output to servo valve coil
- Servo valve output channel can optionally be configured for 4-20 mA analog output signal
- Accepts two digital inputs, which can be configured to drive servo valve output to safe value
- PID execution using the position measurement and remote set point received from the C300 20 ms controller
- Extensive module level diagnostics (PV qualification for AI & AO, LVDT excitation frequency drift check, internal reference check, power supply diagnostic, memory diagnostics, etc.)
- Extensive field level diagnostics (open wire detection for Servo, LVDT, AI [4-20 mA] and DI; LVDT core fallout; read back current diagnostics for Servo and AO [4-20 mA])
- Drive Servo output to safe value on detecting abnormal condition of control components
- Point processing at 2.5 mS period for "LVDT/RVDT signal" and PID execution
- Provides digital dither (current modulation) to compensate stiction in the controlled device (servo valve)
- Supports servo valve position calibration
- Supports redundant solution
- Supplies non-incendive field power

## 7.3. SVPM supports the following I/O interfaces

- LVDT/RVDT/analog input – 2 channels
- Digital input – 2 channels
- Servo/analog output – 2 channels
- 2 PID blocks

## 7.4. Detail Specifications – SVPM

| Parameter | Specification | | |
|---|---|---|---|
| Input/Output Model | CC-PSV201 - Servo Valve Positioner Module | | |
| | CC-TSV211 | Redundant | 18" |
| **Servo Output** | | | |
| Output Type | Bipolar current (Ranges: 10, 20, 40, 80, 160, 320 mA)<br>Unipolar current (Ranges: 50, 300 mA) | | |
| Output Channels | 2 | | |
| Dither | 0-10% of FS, 25-60 Hz | | |
| Output Temperature Drift | 300 ppm per deg C | | |
| Output Current Linearity | 0.325% | | |
| Resolution | 16-bit DAC | | |
| Maximum Resistive Load<br>(24 V supply = 22 VDC through 28 VDC) | Maximum coil resistances allowed for different current ranges with this interface are available in Honeywell DFS document | | |
| Maximum Open Circuit Voltage | ±14 V | | |
| Gap (0 mA) of Output to Field on Switchover | 15 mS maximum | | |
| **LVDT Interface** | | | |
| Input/Feedback | 3/4/5/6 wires LVDT feedback signals, 8 V RMS max., 2.5-3.2 KHz | | |
| Excitation | 8 V RMS max, 2.5-3.2 KHz (max. internal excitation is 50 mA) | | |
| Frequency Stability | 2.5-3.2 KHz ±5 Hz from set value | | |
| Channels | 2 | | |
| Galvanic Isolation (any input terminal voltage referenced to common) | ±500 VDC | | |
| Isolation Technique | Isolation transformer | | |
| A/D Converter Resolution | 16-bits | | |
| Input/Output Range (1) | 8 V RMS max., 2.5-3.2 KHz | | |
| Input Impedance (voltage inputs) | Impedance > 25 Kohm (2.5 KHz to 3.2 KHz) | | |
| Input Scan Rate | 2.5 mS | | |
| Hardware Accuracy (@ CMV = 0 V) | < 1% | | |
| **Analog Inputs** | * AI & LVDT signals are mutually exclusive | | |
| Input Type | Voltage, current (2-wire or self-powered transmitters) | | |
| Input Channels | 2 | | |
| Common Mode Voltage, DC to 60 Hz | -6 to +5 V peak | | |
| A/D Converter Resolution | 16-bits | | |
| Input Range (1) | 0 to 5 V, 1 to 5 V, 0.4 to 2 V, 4-20 mA (through 250 Ω) | | |

| | |
|---|---|
| Maximum Normal Mode Input (differential inputs, no damage) | ±30 V |
| Input Impedance (voltage inputs) | > 10 M Ω powered |
| Maximum Input Voltage (any input referenced to common, no damage) | ±30 V |
| Input Scan Rate | 5 ms |
| Hardware Accuracy (@ CMV = 0 V) | ± 0.075% of full scale (23.5°± 2°C)<br>± 0.15% of full scale (0 to 60°C) |
| **Analog Outputs** | * AO & Servo signals are mutually exclusive |
| Output Type | 4-20 mA |
| Output Channels | 2 |
| Output Ripple | < 100 mV across 250 Ω load |
| Output Temperature Drift | 0.005% of full scale/°C |
| Output Readback Accuracy | ±4% of full scale |
| Output Current Linearity | ±0.05% of full scale nominal |
| Resolution | ±0.05% of full scale |
| Calibrated Accuracy | ±0.35% of full scale (25$^{o}$C) including linearity |
| Directly Settable Output Current Range | 0 mA, 2.9 mA to 21.1 mA |
| Maximum Resistive Load<br>(24 V supply = 22 VDC through 28 VDC) | 760 ohms |
| Maximum Output Compliant Voltage<br>(24 V supply = 22 VDC through 28 VDC) | 16 V |
| Maximum Open Circuit Voltage | 18 V |
| Response Time (DAC input code to output) | 1 mS |
| Gap (0 mA) of Output to Field on Switchover | 15 mS max. |
| **Digital Inputs** | |
| Input Channels | 2 |
| DI Power Voltage Range | 22 to 28 VDC |
| ON Sense Voltage/Current | 13 VDC (min.) or 6.12 mA (min.) |
| OFF Sense Voltage/Current | 5 VDC (max.) or 2.1 mA (max.) |
| Input Impedance | 4.6K |
| Absolute Delay Across Input Filter and Isolation | 1.78 mS |
| Field Resistance for Guaranteed ON Condition | 300 Ω max. @ 15 VDC |
| Field Resistance for Guaranteed OFF Condition | 30 KΩ min. @ 30 VDC |

# 8. Speed Protection Module (SPM) – CC-PSP401

## 8.1. Function

This Series C I/O module accepts up to four speed probe signals in the form of electrical pulses. It provides onboard signal conditioning and two out of three voting. Voted speed signal takes part in speed regulation through a control loop built into the C300 controller. It also provides onboard limit value monitoring to trigger the over speed trip protection relay provided on the same module IOTA. It is intended for use in over-speed protection of turbomachinery. General purpose I/Os provided on this module may also be used in fast applications such as centrifugal compressor anti surge control

## 8.2. Notable Features

- Accepts up to four pulse input signals with two out of three voting and computes the speed and acceleration
- Accepts up to eight digital input signals which can be configured as "trip" input in protection logic
- Provides up to four digital output signals on activation of protection criteria
- Multiple configurable trip limits for speed and acceleration
- Overall loop latency from input change to triggering protection device within 40 mS
- Accepts up to eight analog input signals
- Provides one analog output signal
- Point processing at 2.5 mS and 10 mS period for pulse and analog inputs, respectively
- Supports redundant solution
- Supplies non-incendive field power
- Field diagnostic (zero speed, reverse rotation, missing/deformed tooth, open wire detection for AI and DI, and current read back for AO) supported
- HW/SW diagnostics - PV qualification for AI & DI

**SPM supports the following I/O interfaces:**

- Analog inputs – 8 channels
- Analog outputs – 1 channel
- Digital inputs – 8 channels
- Digital outputs – 4 channels
- Speed (active/passive probes) inputs – 4 channels

## 8.3. Detail Specifications – SPM

| Parameter | Specification | | |
|---|---|---|---|
| Input/Output Model | CC-PSP401 - Speed Protection Module | | |
| | CC-TSP411 | Redundant | 18" |
| **Speed (Active/Passive Probes) Inputs** | | | |
| Input Channels | 4 | | |
| Galvanic Isolation (any input terminal voltage referenced to common) | ±1000 VDC for passive probes interface | | |

| | |
|---|---|
| Isolation Technique | Isolation transformer (on IOTA) for passive probes interface |
| Input Type | Magnetic pickup - min. > 0.5 Vpk; max. < 42 Vpk<br>Active pickup - OFF < 1 VDC; ON > 3.5 VDC for TTL, Off < 6V ; On >10V @ 24 V |
| Input Frequency Range | Magnetic pickup – 150 Hz to 25 kHz<br>Active pickup – 1 Hz to 10 kHz |
| Active input Excitation | 5 or 24 V DC |
| Input Channel | 4 (either active or passive) |
| Resolution | 0.015% of upscale |
| Accuracy | 0.05% of the reading |
| Input Impedance | Passive: 2k Ohm @1 Khz<br>Active: > 1.5 k Ohms |
| Input Scan Rate | 2.5 ms |
| **Digital Outputs** | |
| Output Channels | 4 isolated Form A (SPST/NO) or Form B (SPST/NC) contacts (jumper selectable per output) |
| Contact Type | Gold-clad silver nickel |
| Maximum Load Voltage | 230 VAC (RMS)/24 VDC |
| Maximum Steady State Load Current per Output | Current →Voltage<br>0.5 A → 230 VAC (resistive load, inductive load with 0.4 power factor)<br>2 A → 24 VDC (resistive load) |
| Minimum Load Voltage | 5 VDC (1) |
| Minimum Load Current | 10 mA (1) |
| Isolation (Channel-to-channel, and channel-to-logic common) | 1500 VAC RMS or ±1500 VDC |
| Turn On Time | 20 mS maximum |
| Turn Off Time | 20 mS maximum |
| Contact Life | Operations → % of max. load<br>10,000,0000 → (mechanical life)<br>200,000 @ 3 A (100%) |
| Surge Absorber for Coil | 120 Ω + 0.03$^{o}$F for each channel |
| **Analog Inputs** | |
| Input Type | Voltage, current (2-wire or self-powered transmitters) |
| Input Channels | 8 |
| Common Mode Voltage, DC to 60 Hz | -6 to +5 V peak |
| A/D Converter Resolution | 16-bits |
| Input Range (1) | 0 to 5 V, 1 to 5 V, 0.4 to 2 V, 4-20 mA (through 250 Ω) |
| Maximum Normal Mode Input (differential inputs, no damage) | ±30 V |

| | |
|---|---|
| Input Impedance (voltage inputs) | > 10 M Ω powered |
| Maximum Input Voltage (any input referenced to common, no damage) | ±30 V |
| Input Scan Rate | 10 ms |
| Hardware Accuracy (@ CMV = 0 V) | ± 0.075% of full scale (23.5°± 2°C)<br>± 0.15% of full scale (0 to 60°C) |
| **Analog Output** | |
| Output Type | 4-20 mA |
| Output Channels | 1 |
| Output Ripple | < 100 mV across 250 Ω load |
| Output Temperature Drift | 0.005% of full scale/°C |
| Output Readback Accuracy | ±4% of full scale |
| Output Current Linearity | ±0.05% of full scale nominal |
| Resolution | ±0.05% of full scale |
| Calibrated Accuracy | ±0.35% of full scale (25°C) including linearity |
| Directly Settable Output Current Range | 0 mA, 2.9 mA to 21.1 mA |
| Maximum Resistive Load<br>(24 V supply = 22 VDC through 28 VDC) | 760 ohms |
| Maximum Output Compliant Voltage<br>(24 V supply = 22 VDC through 28 VDC) | 16 V |
| Maximum Open Circuit Voltage | 18 V |
| Response Time<br>(DAC input code to output) | 1 mS |
| Gap (0 mA) of Output to Field on Switchover | 15 mS max. |
| **Digital Inputs** | |
| Input Channels | 8 |
| DI Power Voltage Range | 22 to 28 VDC |
| ON Sense Voltage/Current | 13 VDC (min.) or 6.12 mA (min.) |
| OFF Sense Voltage/Current | 5 VDC (max.) or 2.1 mA (max.) |
| Input Impedance | 4.6K |
| Absolute Delay Across Input Filter and Isolation | 1.78 mS |
| Field Resistance for Guaranteed ON Condition | 300 Ω max. @ 15 VDC |
| Field Resistance for Guaranteed OFF Condition | 30 KΩ min. @ 30 VDC |
| 1) The minimum 10 mA load current and 5 VDC load voltage specified are only valid if the contact has not been previously used in high current/high voltage applications. | |

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