VALCON INTERNATIONAL

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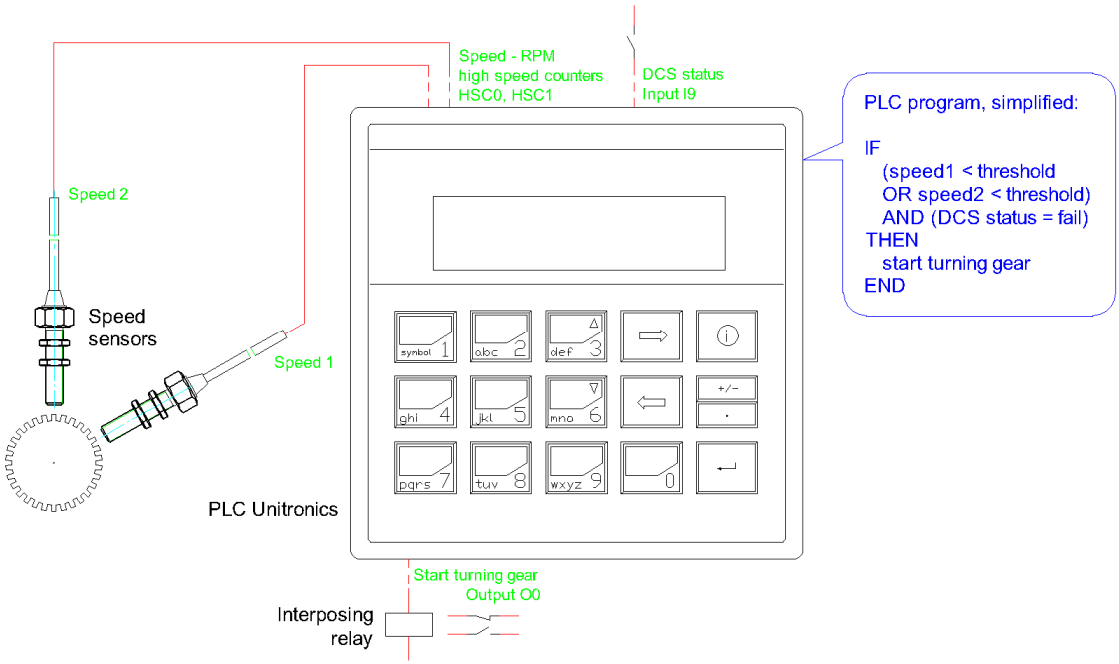
Zero speed detection – loss of DCS

DCS independent turbine protection

General description

DCS independent protection system - zero speed detection - increases reliability and safety of operation for combustion, steam turbines or any other rotating machines. Measured machine speed is compared with preset threshold. When speed is out of preset limit and DCS live signal is not available output signal is set to start turning gear.

Solution described in this document is performed by small PLC with operator panel integrated (Unitronics series M91). Two speed probes (type enabling to detect pulses with frequencies from 0 Hz upwards - i.e. Jacquet DSS EH10) connected to the two high speed counter channels are used to determine machine speed RPM. When **one of two** channels determine speed less then threshold and DCS fail signal is achieved contact output changes its state. The output can be used as a signal to start turning gear or to perform any other required actions.



Key features

- Local rotation speed indicator.
- Local maximal speed before trip remembering and indication.
- Underspeed detection.
- DCS status detection.
- Event log.
- Battery backup for approximately 16 hours operation without AC power supply.

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PLC Unitronics M91

Our proposal is using DCS independent PLC Unitronics M91 executing program to perform all necessary readings, logics and actions. Unitronics (type M91-2-R1) has 3 internal high-speed counter inputs available for frequency measurement. User display and keyboard is available so maintenance personnel can check measured speed and DCS fail signal status on the display or change RPM threshold using user keyboard.

Input pulses converted to RMP can be compared with user-predefined RPM thresholds. In PLC logic consequent actions can be done when some threshold is reached. In general case for turbines it means to close/open output contact to start turning gear.

Since the PLC Unitronics M91 is an autonomous device and DCS independent power supply is available, it continues detecting incoming pulse frequency – machine speed and closes/opens relay contact in case DCS fails. Interposing relay is used to start turning gear. Relay can be included in the turning gear start logic – NO, NC contacts are available.

Installed devices - requirements

- **Two DCS independent speed probes.**
- Small compact PLC with operator panel – Unitronics, M91.
- Uninterruptible power supply 230V/24V DC.
- Battery Module 24V/3,4Ah.
- Zero speed bypass relay (it will energize turning gear motor power supply when turbine revolutions drop below turning gear threshold).

Main advantages

1. Easy and compact PLC construction:
    a. Three high speed counter/frequency measurement inputs and six contact outputs available in PLC itself. No additional I/O modules required.
    b. User interface display and keyboard available directly on the PLC front panel. No additional display and keyboard required.
    c. Serial communication is available in PLC itself (RS232/RS485 port, protocol Modbus supported). OPC communication available. No additional module required.
    d. A small mounting place required.
2. With a separate battery back-upped power supply this solution offers DCS independent protection to start turning gear in case zero speed is reached. This can increase turbine operation safety and extend turbine operating time.
3. DCS fault signal can be connected and processed by PLC's internal logic.

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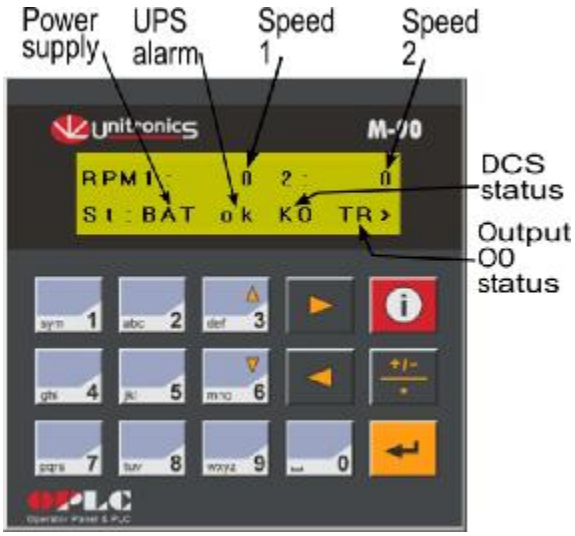
Mechanical implementation

Except speed probes all devices are mounted in steel enclosure (dimensions: 300 x 400 x 210 mm).

Main display – speed, status



Note	Description	Unit
Speed 1	Measured speed 1	RPM
Speed 2	Measured speed 2	RPM
Power supply	UPS power supply mode AC or battery	AC/BAT
UPS alarm	UPS alarm status	ok/AL
DCS status	DCS fail status	KO/ok
Output O0 status	Output contact O0 status	ok/TR