



Using the RTP 3000 for Control and Safety

The RTP 3000 is TÜV approved for Control and Safety in the same Node Processor. This document will outline how this is achieved.

Acquisition of Input Signals.

First, all input signals to be used in the implementation of a Safety Instrumented Function (SIF) must be acquired using RTP's TÜV approved SIL-Rated input modules. These modules provide extensive diagnostics to insure that the signal has been acquired correctly and that the module is operating properly. Digital SIL-Rated modules also have the ability to insure the integrity of the input circuit external to the RTP input module.

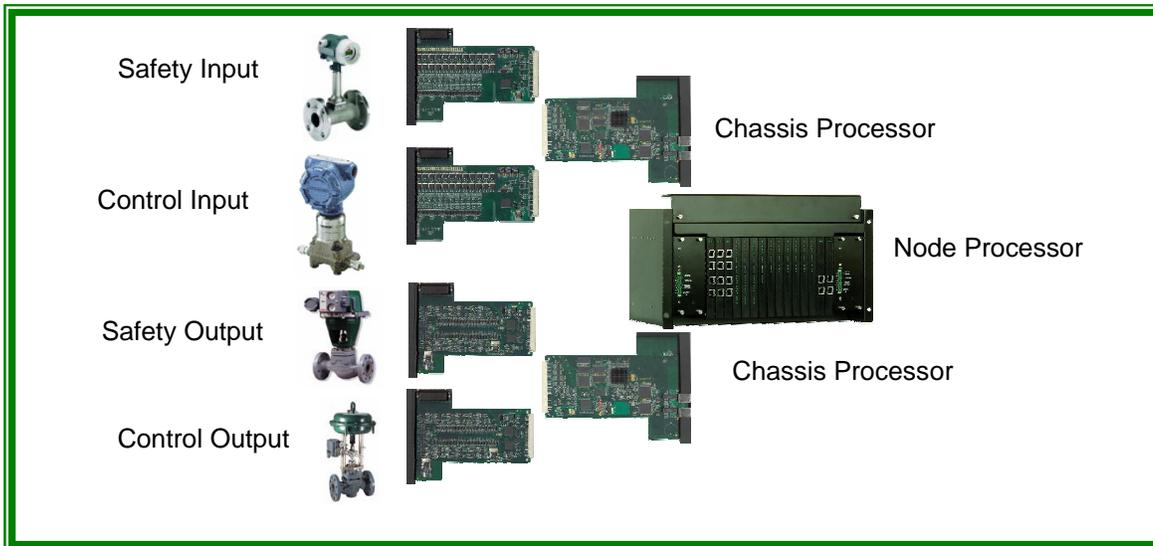
Non-Interfering modules may be used to acquire signals that will be used only in the Basic Process Control System (BPCS). It is certified that the operation of these modules cannot interfere with the proper operation of a SIL-Rated module. Thus these modules can be installed in the same chassis as the SIL-Rated modules. Signals derived from these modules cannot be used in the implementation of SIF's.

Communication of Input Signal to Chassis Processor

Both safety and non-Interfering signals are sent to the Chassis Processor over the RTP backplane. Since the Chassis and the Chassis Processor are TÜV approved for applications up to SIL-3, this means that all signals, both safety and control, are handled as if they were part of a SIF over the backplane and into the Chassis Processor.

Diagnostic safeguards on communications between Input Modules and the Chassis Processor include:

- ◇ All messages are sent in a command and response manner, i.e. the message is read by the Chassis Processor, regenerated by it, and sent back to the input module where it is compared with the message sent to insure there has been no corruption.
- ◇ The address of the receiving device, in this case the Chassis Processor, is embedded in the message multiple times to insure that only the intended recipient reacts to the message.
- ◇ Each message is sent once, then inverted and sent again. The receiving device, in this case the Chassis Processor, compares the two messages to insure they are identical.



3000 Controller Family

RTP offers a complete family of high-integrity Safety Instrumented Systems, all following the standards of IEC61508. For the highest level of integrity and availability, the 3000-T Triple Modular Redundant System features 2oo3D voting with triple, dual, or simplex I/O to obtain the required SIL rating.

The 3000-D Safety Instrumented System is built on the same advanced technology as the 3000-T, for dual redundant 1oo2D solution. The 1oo2D voting uses advanced diagnostics to assist in results adjudication. According to IEC61508, 1oo2D systems can achieve the same SIL rating as 2oo3D systems. The 3000D features dual-redundant processors with triple, dual, or simplex I/O as required.

When processor redundancy is not a requirement, the 3000-S Single processor configuration provides integrity and availability that exceeds that of competing single systems. With its built-in data validation schemes and redundant host communications, secure measurement and control are achieved.

The 3000-T, 3000-D, and 3000-S support up to 16 chassis of I/O providing high availability systems with I/O counts as large as 10,000 I/O.

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Communication from Chassis Processor to Node Processor

The SIL-3 Rated Chassis Processor sends the input messages to the Node Processor(s) over RTP's TÜV approved SIL-3 rated 100 megabit Triplicated Ethernet I/O network. Again, both control and safety signals are handled with the integrity intended and approved for Safety Applications. At this level, the integrity includes increased error checking on the network that makes the integrity of an RTP copper implemented network greater than the integrity of a fiber implemented standard Ethernet network. When the Node Processor receives the signals, safety and control signals are separated. This is done in the application code. Each application page, or Logic Form, has properties. By default, all Forms in a 3000 have a property call Part of SIF and all variables on the pages are Read Only.

The Part of SIF designation gives the pages special attributes that are relevant to Safety Instrumented Systems (SIS). Among these attributes is the fact that all variables used on these forms become read only variables. As such, the variables cannot be changed by anything outside the 3000. This prevents accidental or intentional manipulation of safety variables.

The properties on control pages are changed to set Part of SIF to false and make the variables accessible to the operator and to other nodes on the system, either other RTP nodes via RTP's peer-to-peer network or other nodes via OPC or Modbus.

First Independent Output Vote

Each Node controller solves the logic twice and compares the two results. If the results agree, an output message is sent across RTP's TÜV approved SIL-3 rated 100 megabit Triplicated Ethernet I/O network to each Chassis Processor.

Communication to Chassis Processor and Second Independent Output Vote

The Chassis Processor must receive two identical messages before it takes any action. If the 3000's are in a TMR configuration, the

Chassis Processor does a 2oo3D vote. If the 3000's are redundant, the Chassis Processor compares the two messages and does a 2oo2D vote. If the 3000 is simplex, it sends both of its results to the Chassis Processor, which confirms that the two messages agree. This is the second independent output vote. From Chassis Processor to output module, every signal is handled as a safety signal in the same manner that the input messages were handled.

- ◇ All messages are sent in a command and response manner, i.e. the message is read by the Chassis Processor, regenerated by it, and sent back to the input module where it is compared with the message sent to insure there has been no corruption.
- ◇ The address of the receiving device, in this case the I/O module, is embedded in the message multiple times to insure that only the intended recipient reacts to the message.
- ◇ Each message is sent once, then inverted and sent again. The receiving device, in this case the output module, compares the two messages to insure they are identical.

Final Independent Output Vote

Safety messages are sent to SIL-Rated output module. The SIL-Rated output modules contain special circuitry to compare the two messages from the Chassis Processor. Thus the final output vote is done by the output module itself.

Control outputs can be wired to either SIL-Rated or Non-Interfering modules. Again, SIL-Rated modules have more extensive diagnostics, often including the ability to diagnose the integrity of the output circuit.

NOTE: Signals used for control can be read from or written to SIL-Rated or Non-Interfering Modules, but signals used in SIF's must be read from and written to SIL-rated I/O Modules

About RTP

Founded in 1968, RTP Corp. is a developer and manufacturer of high-performance critical control and safety systems. Markets for RTP Corporation's products include process control and safety systems, and nuclear power plant systems. RTP offers a wide range of rugged hardware and a complete suite of software for industrial control solutions that include seamlessly redundant and triplicated systems for mission-critical applications.