

TTTech Disturbance Injection



TTP Disturbance Node – The Disturbance Injection Device for TTP

Simulate System Behavior in Rough Environment

Controlled fault injection is a powerful and inexpensive way to test and validate a system, and it may uncover more problems than simply running an “instrumented system”. TTP Disturbance Node provides all the necessary means to inject realistic disturbances into a TTP-based distributed system. The node can be used in a running system or with a test setup in the laboratory. TTP Disturbance Node is used to study the effects of faults on system behavior, and to test fault tolerance properties of the complete system. When creating fault scenarios for distributed systems, the user needs a powerful tool to set up fault injection campaigns in a fully reproducible and programmable manner. TTP Disturbance Node satisfies this requirement. It can be used to inject classes of faults thus allowing analyzing the behavior at the physical, logical, and application layer. Even the most severe classes of faults, namely Byzantine SOS faults, can be injected.

Fault Tolerance for Safety-Critical Applications

The Time-Triggered Protocol (TTP[®]) is designed to meet the requirements of safety-critical applications. It provides services for the construction of fault-tolerant, distributed, hard real-time systems. System requirements demand continued operation in the presence of faults. TTP Disturbance Node test scenarios can cover exceptional situations which are not covered by test scenarios during normal operation. By injecting faults, TTP Disturbance Node enables the construction of exceptional test scenarios and the exposure of weaknesses in the fault tolerance and safety of the system.

Some Potentially Dangerous Disturbances that TTP Disturbance Node can inject

- Loss of data transmission
- Short-circuit, open-circuit and mismatched termination of bus wires
- Loss of specific data (reproducible experiments are possible)

TTP Disturbance Fault Injection Capabilities

| Emulated Faults | Disturbances created with TTP Disturbance Node | | | | | | | |
|---|--|------------------------|-----------------------------|----------------------|----------------------|------------------------------|---|--|
| | direct access logic to differential signal lines | mismatched termination | TTP synchronous disturbance | periodic disturbance | sporadic disturbance | split whole network into two | trigger external devices at defined times | trigger external device at arbitrary times |
| loss of transmission (external transient) | | | | ✓ | ✓ | | ✓ | ✓ |
| faulty sender (outgoing link) | | | ✓ | | | | ✓ | |
| cable broken | ✓ | | | | | | | |
| short high and low | ✓ | | | | | | | |
| short high/low to supply/gnd | ✓ | | | | | | | |
| termination fault | | ✓ | | | | | | |
| supply or electromagnetic interference | | | | | | | ✓ | ✓ |
| babbling idiot occurrence | | | ✓ | ✓ | ✓ | | | |
| SOS failures | | | | | | ✓ | | |

General Features

- Examination of the application behavior in the presence of disturbances
- TTP Disturbance Node is invisible to the network unless activated
- Physical layer tests: mismatched termination and short-circuit
- XML environment for setting up reproducible fault injection campaigns
- Analysis of disturbance effects on signal shape (using oscilloscope)
- Analysis of frame and membership status (using monitoring node)

Interfaces

- TTP interface based on austriamicrosystems AS8202NF TTP controller with MFM/Manchester coding on RS485 physical layer (up to 5 Mbit/s asynchronous, 2 channels). Support for MII coding in a 25 MBit/s operating mode is optional.
- RS232 interface for download of configuration data and disturbance setup
- Sub-D socket for trigger input and trigger output and power supply

Specifications

- Dimensions (mm): 172 x 172 x 55
- Weight: 924 g
- Operating temperature: 0 °C – +70 °C
- Storage temperature: -40 °C – +85 °C
- Robust housing
- Power requirements: input voltage 9 – 60 V DC at max. 15 W and max. 2 A

Configurable Disturbances

- User-configured disturbances – single, multiple, periodic, intermittent, permanent
- Selectable disturbance triggers:
 - Synchronized to TTP
 - External trigger input
 - Asynchronous/strictly periodic
 - Pseudo-random (reproducible)
- Disturbance of one or both TTP channels simultaneously
- Triggers for external hardware (oscilloscope, signal generator, HF burst generator) to disturb arbitrary or specific transmissions with any kind of custom signal/burst
- Tests that can be set up to confirm fault tolerance against babbling idiots
- Tests that can be set up to confirm clique detection and removal
- Injections of faults that exceed the TTP fault hypothesis
- “Bus break” feature: separate a bus into two groups to force effect of dual cable break
- Short-circuit and open-circuit faults on differential lines
- Mismatched termination
- Specific enforcement of bus to “high” or “low” with a strong driver

Subject to changes and corrections.

For further information, please contact products@tttech.com.

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