

# Endurance Test System for Belt Pretensioners



Customer: Automotive Supplier  
Final Product: Belt pretensioner  
Industry: Automotive

## Short Description:

We developed an endurance test system for two pretensioner pairs with continuous monitoring and recording of all electrical and mechanical parameters, as well as CAN-messages over a time period of up to 90 days under various climatic conditions. By means of climate chamber software, various climate profiles with corresponding test sequences are being run.

## Customer Requirements:

- Recording four separate length, force and temperature signals, for each of the four pretensioners individually
- Creating specific firmware on the NI-CAN card to simulate true environmental conditions in the vehicle
- Logging of all data
- Control of a climate chamber
- Porting of existing sequences from NI LabVIEW to NI TestStand, as well as parameter-based test steps
- Spreadsheet-based script editor for simple generation of endurance test sequences
- Sequential control of the two belt pretensioner pairs using one 20V/120A power supply, at peak currents of up to 50A per pretensioner

## Implemented Solution:

The endurance test system is built in a 40U tall 19" cabinet, holding the Industrial PC along with the data acquisition board, CAN board and GPIB controller. Keyboard and mouse are also integrated in the rack using a keyboard drawer, as well as the 17" touch screen monitor.

Further equipment includes the Konrad power supply unit, the Agilent 20V/120A power adaptor and the UPC.

Other customer-specific hardware was integrated in a 6U tall 19" drawer, including four Konrad current measurement modules and the signal conditioning system NI SC-2345 with the measurement converter for force and temperature signals. All plugs necessary for supplying the belt pretensioners and sensors were integrated into the front panel of this drawer.

The rack even offers space for the expansion with a second Industrial PC, for future addition of a CAN residual bus simulation. If necessary, the remaining space in the cabinet can be used for integration of the control electronics of a third belt pretensioner pair.

A data acquisition rate of maximum 1kHz was defined for the 24 analog channels; the 36 CAN-signals are acquired at a rate of 100Hz. The measurement values are time-synchronized, for easy signal comparison between the external sensors and the pretensioner's sensors. A measurement data server collects the data from all three test systems and allows further analysis, while still acquiring data.

The software has been developed in a universal manner, allowing control of climate chambers and running multiple different test sequences depending on various climate profiles. Using this KT-Environment-Server-Application, different types of climate chambers from multiple vendors can be integrated via plug-ins.

## Software:

NI TestStand:	Sequence control Editor, Debugger
NI LabVIEW:	Test Step libraries
KT-Operator Interface:	Operator interface Debugging
KT-Project:	Test step library Functional test
Custom developments:	Konrad Endurance Test Software Konrad Climate Chamber Software

## Hardware:

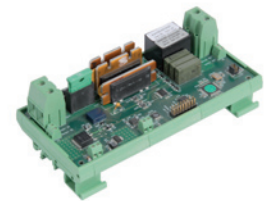
### PCI-based test system

#### Instrumentation:

NI PCI-6259 16Bit, 1MS/s, 32 single-ended analog inputs  
48 Digital-I/O, 4 analog outputs

Signal conditioning system NI SC-2345:  
SG-24 for force sensor acquisition  
TC-02 for temperature acquisition

4x KT current measurement modules,  
measurement range: 1mA to 50A  
Measurement range change via 4 TTL digital inputs  
Output voltage: 0 to 5V  
Measurement accuracy: 1% full scale



#### Custom-specific hardware control

NI PCI-6528 24 digital I/O

#### Communication

2 x NI PCI-8461/2 Series 2, high-speed CAN 2 port, 1MBit/s

NI PCI-GPIB interface

#### Power adapter and energy supply

Agilent 6031A 20V / 120A, controlled via GPIB

KT power supply unit

#### Adaption

Pretensioner-specific recording for force and length measurement, suitable for operation within a climate chamber

#### Interface

Customer-specific hardware interface with all electronics and connections for the original cable tree of the pretensioner, connections for length, force and temperature sensors

## Summary:

With this endurance test system, the customer got a system, which can be adapted to virtually any future requirements by using the Konrad climate chamber software.

By designing three identical test stands, up to 12 belt pretensioners can be tested at the same time.

Automotive +++ Avionics +++ Semiconductors +++ Telecommunication +++ Medical +++ Industrial