BOLAB SYSTEMS GMBH

100-TS Series

Arbitrary 4-Quadrant
Voltage and Current Amplifiers

400 W - 18.000 W
DC ... 200 kHz / 1 MHz

Arbitrary 4-Quadrant Voltage and Current Amplifiers 100-TS Series 400 W - 18.000 W DC - 200 kHz / 1 MHz

Special Features

- DC ... 200 kHz full range bandwidth
- DC up to 1 MHz (small signal -3 dB)
- Output voltage 35 V / 70 V / 75 V
- Rise time / fall time up to 100 V/µs
- Arbitrary function with 1.000.000 memory data points
- Internal resistor 0 ... 200 mΩ (Option)
- Analogue input 0 ... ±10 V for voltage control
- Option for running as current amplifier
- Monitor outputs for measured values of voltage and current
- WaveMaster software for graphical waveform generation
- Simulation of imported oscilloscope signals
- Modularly expandable up to 18 kW (Systems > 1 kW)
- USB interface standard
- Voltage resolution less than 0.001 V
- Linearity 0,1% DC
- DC - Offset < 1 mV
- DLL's for C++, LabView™, Vector-CAPL, Python, C#, MathLab, etc.

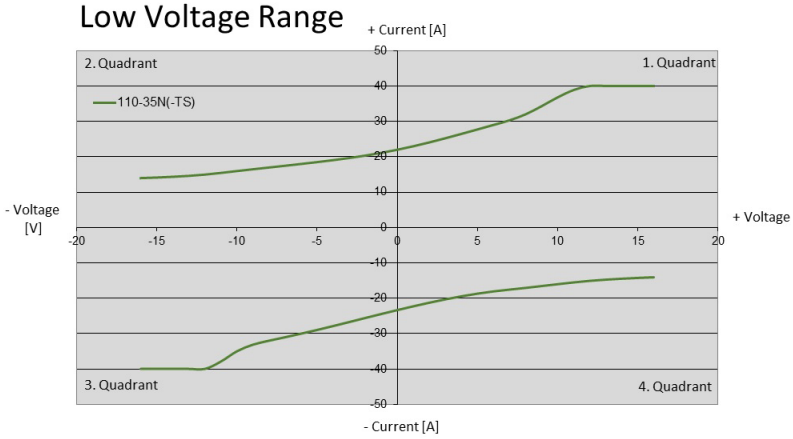
Instrument Overview

+35 V / -16 V

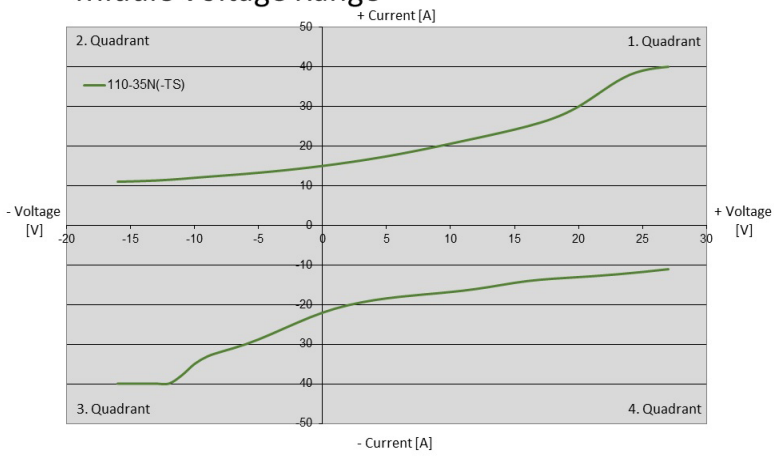
Models	Low voltage -16 V...+16 V	Middle voltage -16 V...+27 V	High voltage -16 V...+35 V	Output Power	Size
105-35N-TS	15 A	15 A	11 A	400 W	3 U
110-35N-TS	38 A	38 A	28 A	1.000 W	4 U
120-35N-TS	76 A	76 A	55 A	2.000 W	14 U
130-35N-TS	114 A	114 A	83 A	3.000 W	18 U
140-35N-TS	152 A	152 A	110 A	4.000 W	22 U
150-35N-TS	190 A	190 A	138 A	5.000 W	26 U
160-35N-TS	228 A	228 A	165 A	6.000 W	30 U
180-35N-TS	304 A	304 A	220 A	8.000 W	2 x 22 U
200-35N-TS	380 A	380 A	276 A	10.000 W	2 x 26 U
220-35N-TS	456 A	456 A	331 A	12.000 W	2 x 30 U
250-35N-TS	570 A	570 A	413 A	15.000 W	3 x 26 U
280-35N-TS	684 A	684 A	496 A	18.000 W	3 x 30 U

110-35N-TS

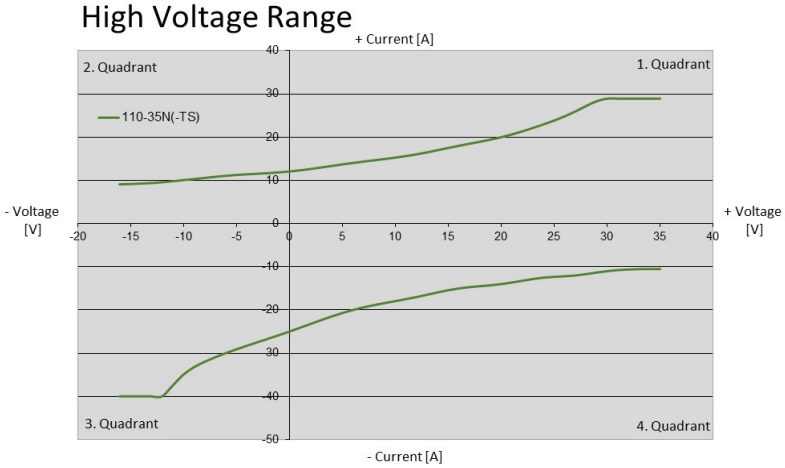
Low Voltage Range



Middle Voltage Range



High Voltage Range



110-70N-TS

Arbitrary 4-Quadrant Voltage / Current Amplifiers 100-TS Series 500 W - 18.000 W DC - 200 kHz / 1 MHz

Instrument Overview

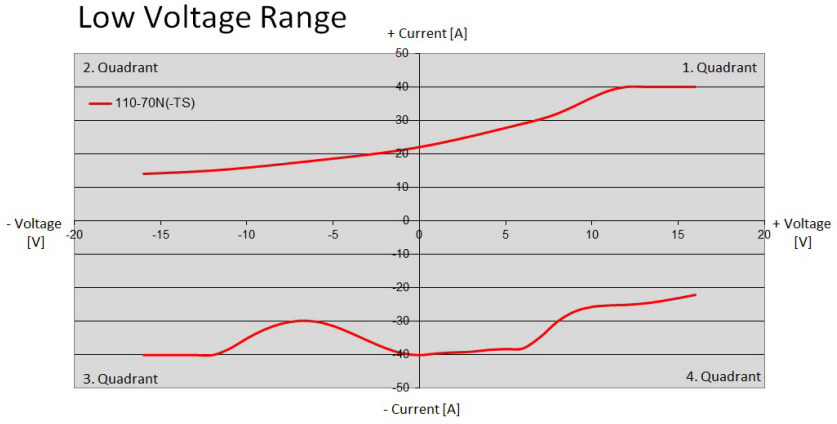
+70 V / -16 V

Models	Low voltage -16 V...+16 V	Middle voltage -16 V...+27 V	High voltage -16 V...+70 V	Output Power	Size
105-70N-TS	19 A	19 A	7 A	500 W	3 U
110-70N-TS	38 A	38 A	14 A	1.000 W	4 U
120-70N-TS	76 A	76 A	29 A	2.000 W	14 U
130-70N-TS	114 A	114 A	43 A	3.000 W	18 U
140-70N-TS	152 A	152 A	57 A	4.000 W	22 U
150-70N-TS	190 A	190 A	71 A	5.000 W	26 U
160-70N-TS	228 A	228 A	86 A	6.000 W	30 U
180-70N-TS	304 A	304 A	114 A	8.000 W	2 x 22 U
200-70N-TS	380 A	380 A	143 A	10.000 W	2 x 26 U
220-70N-TS	456 A	456 A	171 A	12.000 W	2 x 30 U
250-70N-TS	570 A	570 A	214 A	15.000 W	3 x 26 U
280-70N-TS	684 A	684 A	257 A	18.000 W	3 x 30 U

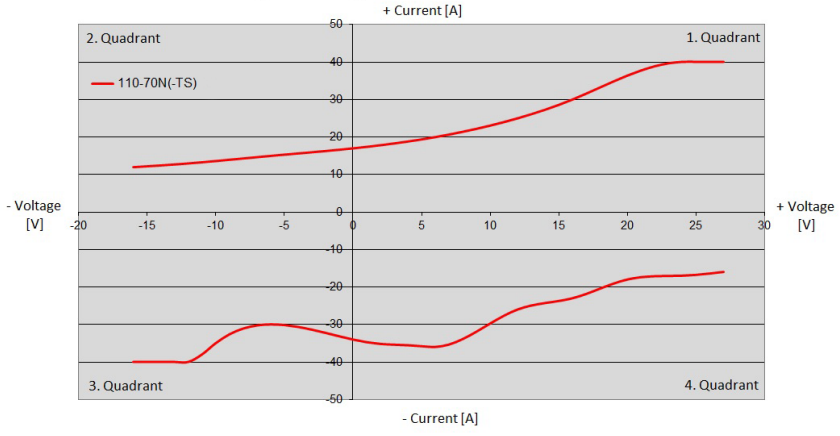
- ✓ **Outstandingly Powerful**
- ✓ **Modular Design**
- ✓ **Unlimited Signal Waveforms**

110-70N-TS

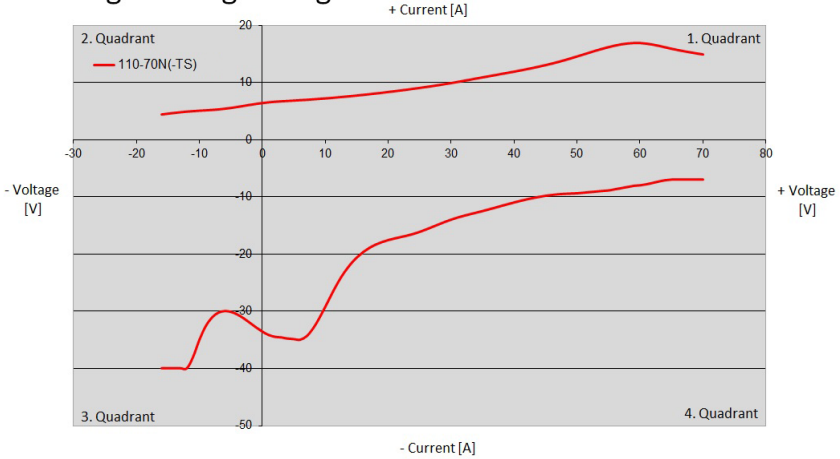
Low Voltage Range



Middle Voltage Range



High Voltage Range



Test System with 4 kW

105-70N-TS Rear

Arbitrary 4-Quadrant Voltage and Current Amplifiers 100-TS Series 500 W - 18.000 W DC - 200 kHz / 1 MHz

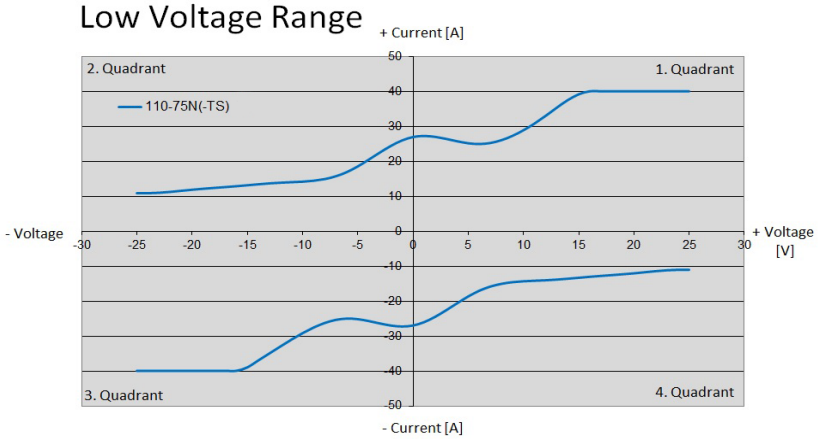
Instrument Overview

+75 V / -75 V

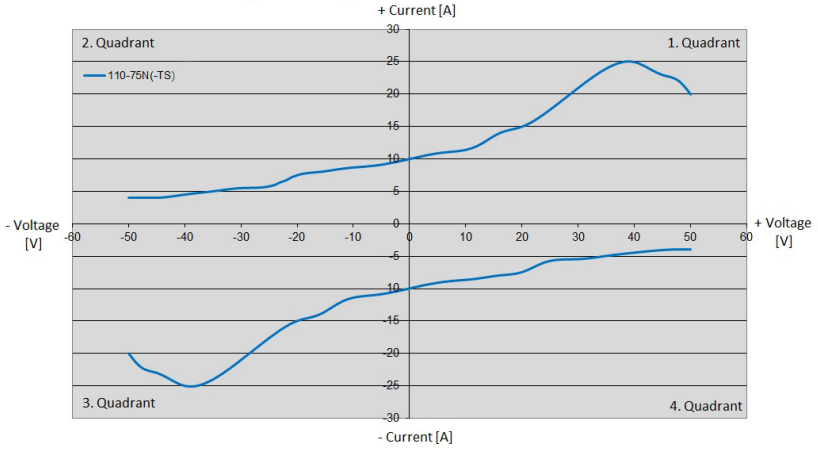
Models	Low voltage -25 V...+25 V	Middle voltage -50 V...+50 V	High voltage -75 V...+75 V	Output Power	Size
105-75N-TS	19 A	10 A	7 A	500 W	3 U
110-75N-TS	38 A	19 A	14 A	1.000 W	4 U
120-75N-TS	76 A	38 A	27 A	2.000 W	14 U
130-75N-TS	114 A	57 A	40 A	3.000 W	18 U
140-75N-TS	152 A	76 A	53 A	4.000 W	22 U
150-75N-TS	190 A	95 A	67 A	5.000 W	26 U
160-75N-TS	228 A	114 A	80 A	6.000 W	30 U
180-75N-TS	304 A	152 A	106 A	8.000 W	2 x 22 U
200-75N-TS	380 A	190 A	133 A	10.000 W	2 x 26 U
220-75N-TS	456 A	228 A	160 A	12.000 W	2 x 30 U
250-75N-TS	570 A	285 A	200 A	15.000 W	3 x 26 U
280-75N-TS	684 A	342 A	239 A	18.000 W	3 x 30 U

110-75N-TS

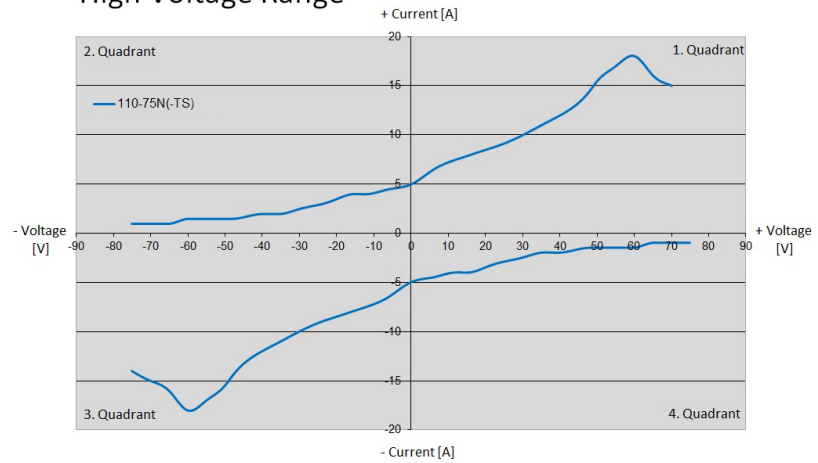
Low Voltage Range



Middle Voltage Range



High Voltage Range



Selectable Operating Voltage

Three selectable operating-voltage ranges allow to adapt to applications for high voltage / low current or low voltage / high current.

Especially when controlling extremely low impedance loads, the operating voltage range can be reduced to one third of the maximum output voltage. This leads to an immense reduction of power dissipation.

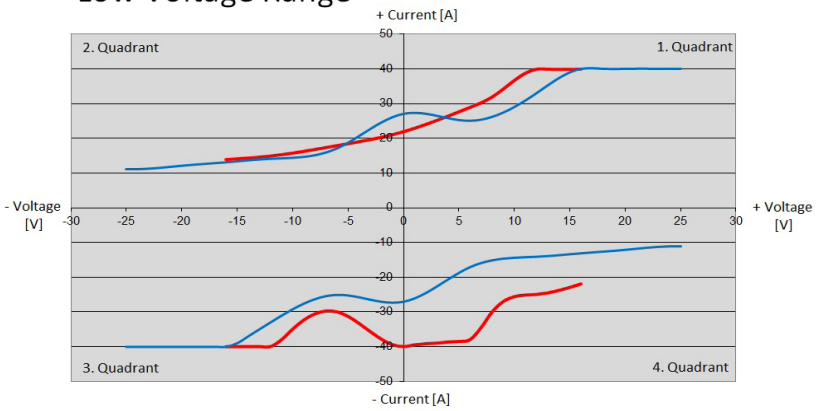
→ Reduction of power dissipation
→ One system for 12 V / 24 V / 48 V vehicles

Comparison

110-70N (-16 V...+70 V, 40 A, 1000 W)
versus
110-75N (-75 V...+75 V, 40 A, 1000 W)

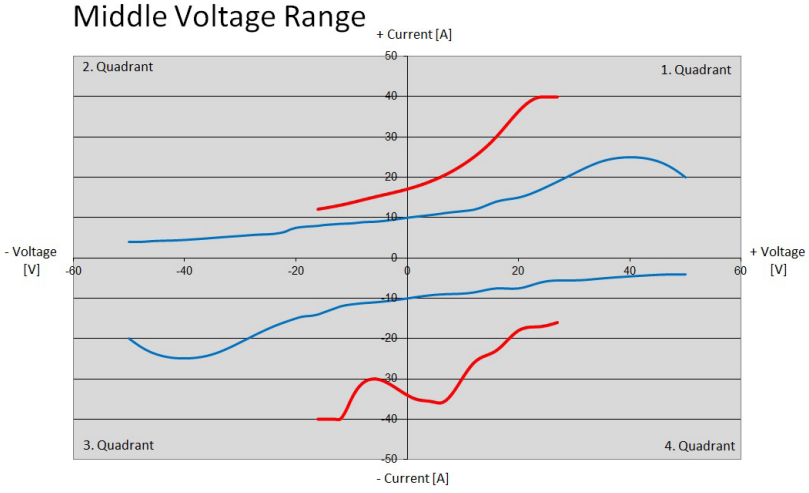
Low Voltage Range

110-70N-TS, -16 V...+16 V
110-75N-TS, -25 V...+25 V



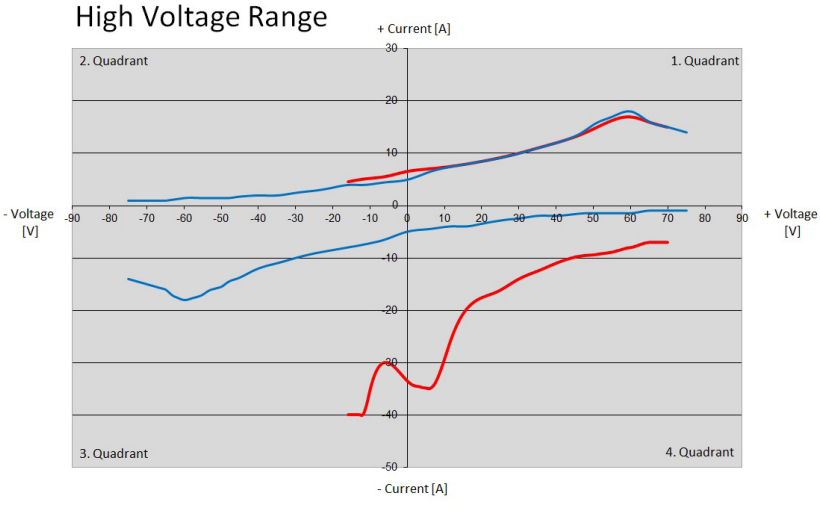
Middle Voltage Range

110-70N-TS, -16 V...+27 V
110-75N-TS, -50 V...+50 V



High Voltage Range

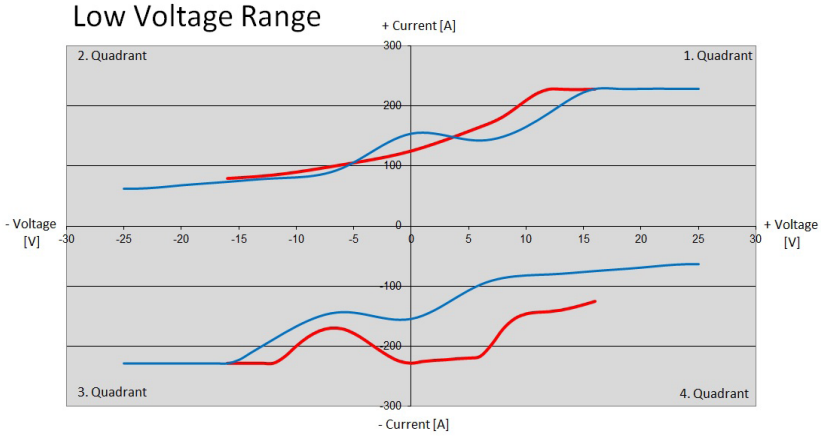
110-70N-TS, -16 V...+70 V
110-75N-TS, -75 V...+75 V



Comparison

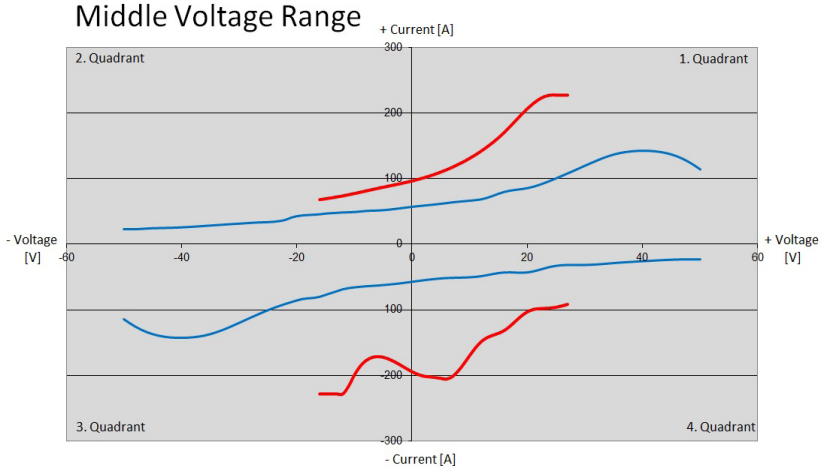
160-70N (-16 V...+70 V, 228 A, 6000 W)
versus
160-75N (-75 V...+75 V, 228 A, 6000 W)

Low Voltage Range



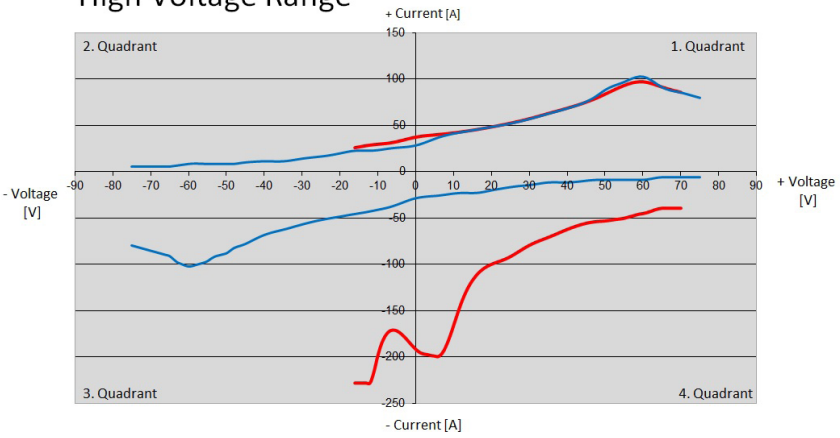
160-70N-TS, -16 V...+16 V
160-75N-TS, -25 V...+25 V

Middle Voltage Range



160-70N-TS, -16 V...+27 V
160-75N-TS, -50 V...+50 V

High Voltage Range



160-70N-TS, -16 V...+70 V
160-75N-TS, -75 V...+75 V

Test System Architecture

General

The 100-TS series are linear precision 4-quadrant power amplifiers for fast voltage and current signals - each positive and negative (bipolar).

They also work as sink in applications to absorb power. Extremely high bandwidth at highest power requirements, necessary for fast signals, characterizes this series.

Especially these amplifiers are characterized by their signal quality.

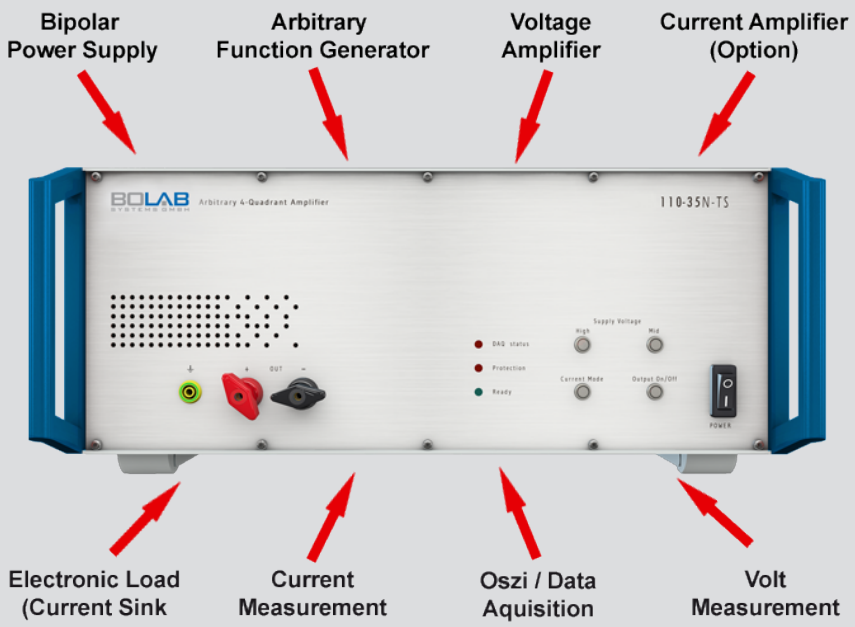
Arbitrary Functionality

SIBO´s arbitrary power amplifiers include a huge memory of 1.000.000 data points to store arbitrary waveforms in the instrument itself. No arbitrary waveform generator or any other controlling instrument is needed.

This makes these 4-quadrant amplifiers unique in the world market.

The easy-to-use WaveMaster software, that is standard in scope of delivery, allows to generate waveforms by means of a graphical user interface or via tabular input.

Multiple Instrument Functions In One Device



Monitor Outputs

Located on the back of the instruments there are monitor outputs for voltage and current with the respective measured values.

Output values are 0 ... ±10 V
for 0 ... $\pm V_{rated}$ respectively 0 ... $\pm I_{rated}$.

The current is measured by means of an internal shunt with an accuracy of approx. 1 %.

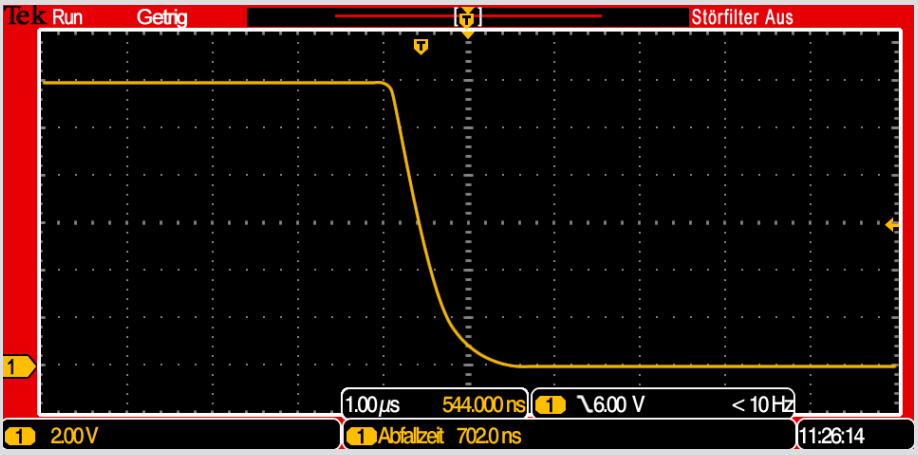
Optionally a current sensor with 0.01 % accuracy can be integrated easily.

Ouput ON/OFF

With its output on/off switch at the front of the instruments, the output can be activated or deactivated. When deactivating, there is a completely galvanic interruption to the tested devices.

Signal Quality

- Rise time: < 1 µs
- Fall time: < 1 µs
- No overshot / no undershot



Protective Functions

Various protective functions avoid damage of the instrument and also guarantee protection for tested devices.

Output voltage and current can be limited and also over-temperature shutdown is included.

The inside calculation of power dissipation and totally monitoring of current ensure perfect short circuit and over-voltage protection.

Also for security aspects an interlock shut down can be triggered.

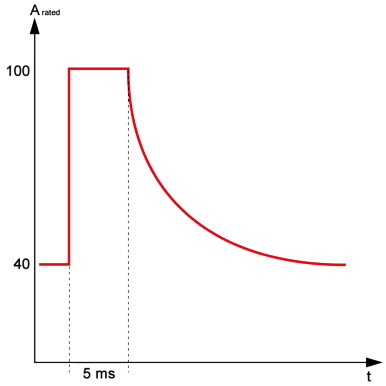
Short-Time Current

In a period of time of 500 ms, the amplifier systems supply a short-time current.

E.g. the 1.000 W instruments with their 40 A reach 100 A.

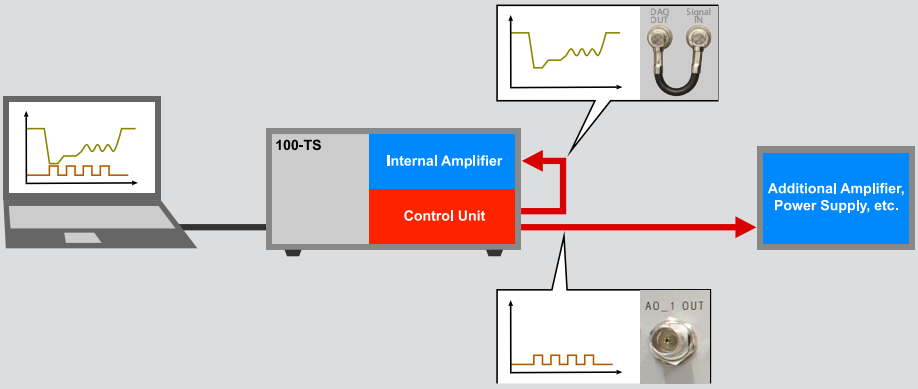
Generally the instruments provide a short-time current of approximately two times higher than $I_{DC\ Max}$

Short Time Current At 110-75N-TS



Test System Architecture
Two synchronous waveform signals

Analog Amplifier / Signal Processing



2 Analog Outputs (16 bit), 2,8 MS/s
(optional 4 / 8 via external control unit)

- First output for control of the internal amplifier
- Second output for control of external hardware (amplifier / power supply)

4 Counter Inputs/ Outputs

- Electronic switch S5
- Electronic switch S5 negated

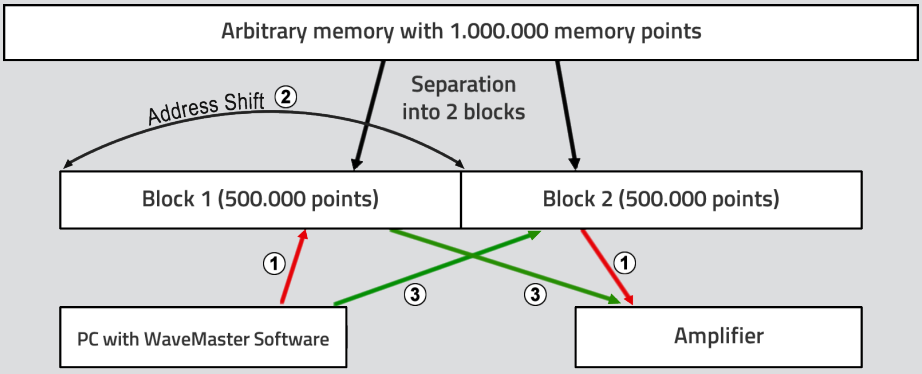
16 Analog Inputs

- Monitor U (internally wired) (New HMI)
- Monitor I (internally wired) (New HMI)
- Remaining inputs for measurements at user defined measuring points (New HMI)

24 Digital Inputs/ Outputs

- Run-Bit
- External Trigger
- Internal Trigger

Unlimited Waveform Memory



① While the PC transfers data to block 1 of the arbitrary memory, block 2 is sending data to the amplifier part.

② After block 2 is done with its signal data, an address shift occurs.

③ While the PC transfers data to block 2 of the arbitrary memory, block 1 is sending data to the amplifier part.

⇨ This technology enables an endless, continuous data stream to the amplifier.

- ⇨ Compared to a function generator with its limited arbitrary memory there is no limitation of the size of the waveform.
- ⇨ A waveform with small spikes and interruptions of e.g. 100 µs and long constant levels in between can be simulated easily.

Analog Remote Control

Amplifier Control

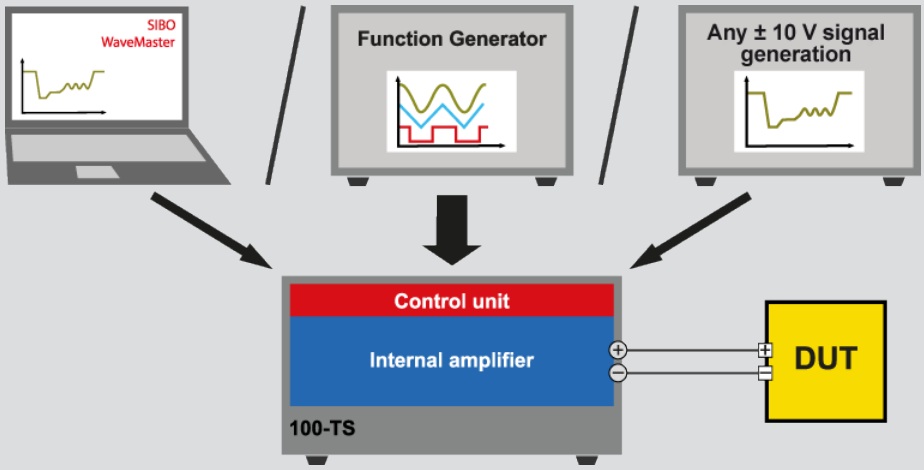
There are many ways to control SIBO amplifier systems:

- BOLAB WaveMaster Software
  This PC software generates waveforms, sends the curves to the internal data memory and runs the process. All selections in the instrument are done automatically.

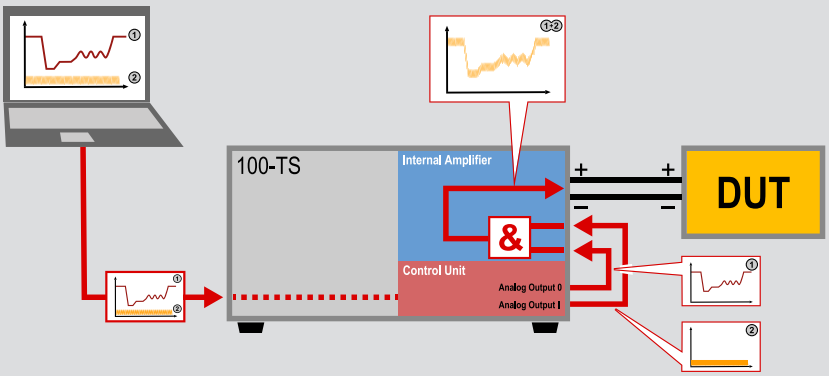
- Function Generator
  Standard function generators can be connected directly to the input of the amplifier.

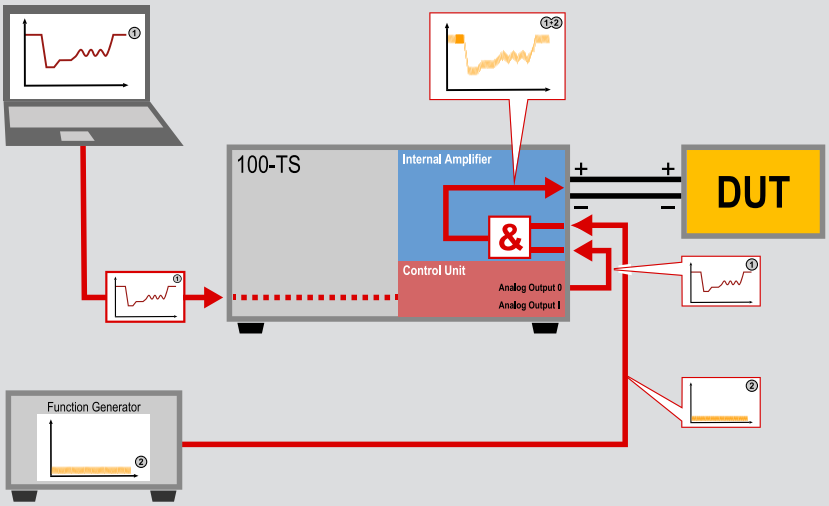
- NI DAQ Card, VT System (Vector), etc.
  Through their 0..±10 V input, other control units can be used for waveform generation. Automated test systems don´t need programming adaptions.

Multiple Control Possibilities



Adding two indepenant signals to one waveform





Amplifier Control

With an optional isolation amplifier, the instruments have two analog inputs. These inputs are added in the isolation amplifier. This allows to add e.g. an interference on a standard waveform.

The second waveform may either come from the PC or from an external Function Generator.

Modular Design

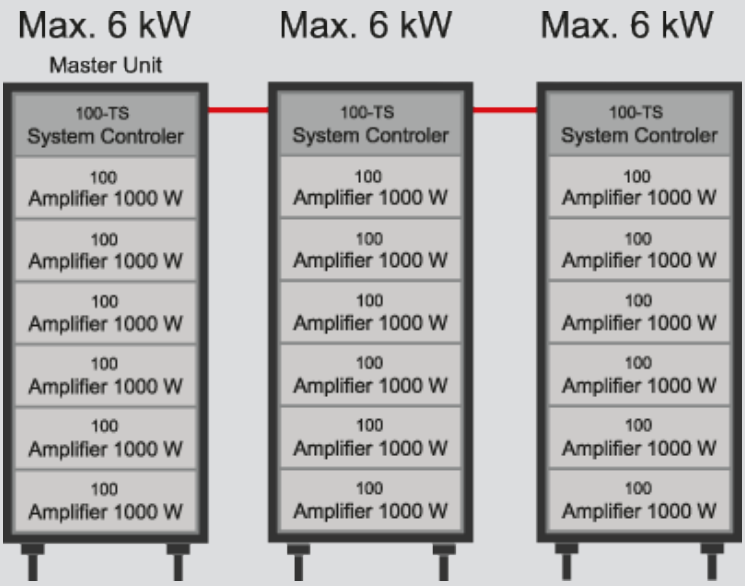
Voltage And Current Control

Both voltage and current control of the comprehensive amplifiers is possible. This can be selected on the front panel of the instrument.

Control input is 0 ... ±10 V
for 0 ... $\pm V_{rated}$ respectively 0 ... $\pm I_{Irated.}$

An optional compensation network for current control is necessary, which achieves highest slew rates and signal quality for current signals.

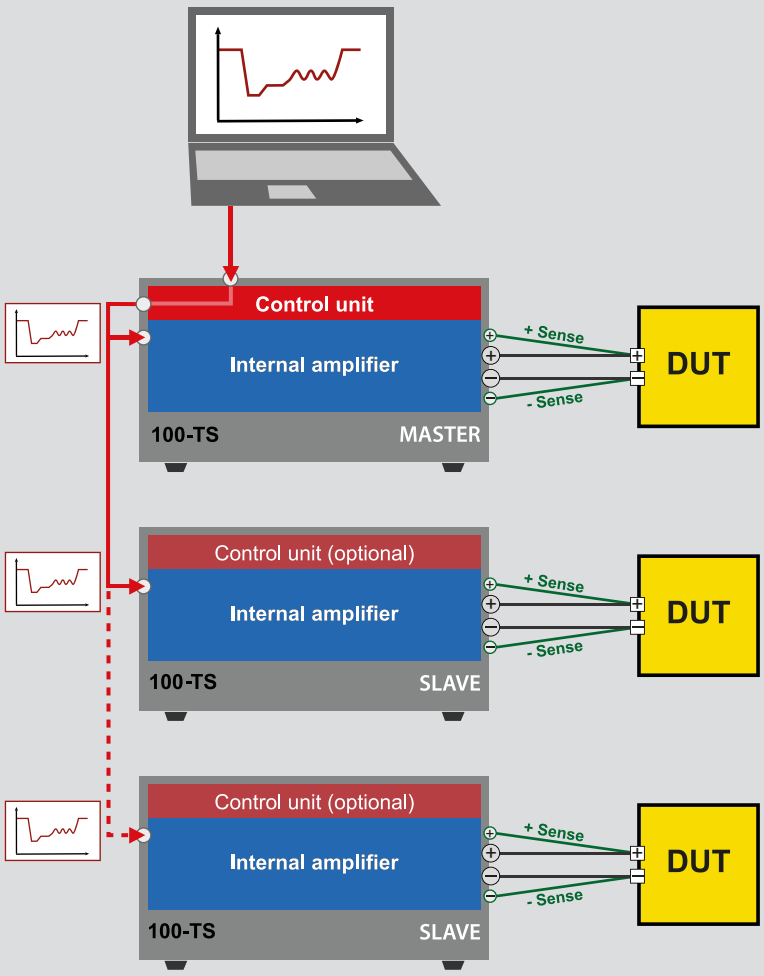
Modular Concept / Modularly Expandable



- Modular hardware architecture
- Starting with one single unit of e.g. 1 kW
- Extension up to 18 kW in parallel
- Building up 3-phase systems with up to 6 kW per phase
- Serial connection for increasing voltage
- In case of a defective module, only this module needs to be repaired
- Each module has its own indication for functional capability

Cascading

Synchronous DUT Control



One Waveform, Many Amplifiers

- One waveform can be simulated synchronously with several amplifiers
- Each DUT has its own sense

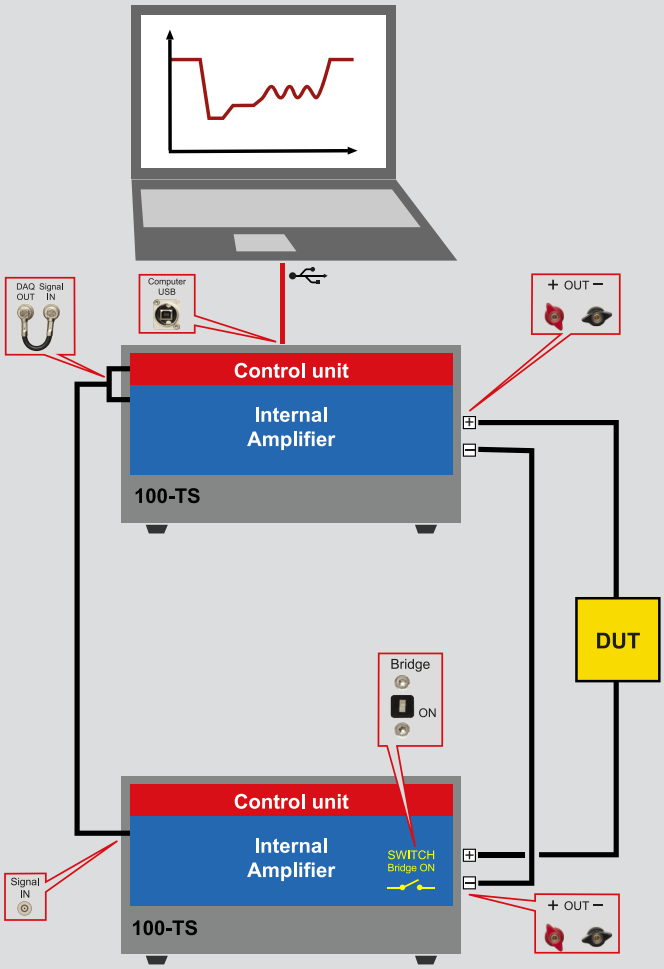
Serial Operation

Serial Operation

For high-voltage applications, instruments can be connected.

- Two instruments can be connected in series. Bridge switch must be toggled at one amplifier
- For three and more instruments in series, an internal isolation amplifier in each instrument is necessary

Two Instruments In Series



WaveMaster Software

Waveform generation and 4-quadrant amplifier control

Special Features

- Easy to use graphical waveform editor and tabular input possibility
- Command library for integration into automated test systems:

  - LabView(TM)
  - Vector CANoe (CAPL)
  - C#
  - C++
  - ANSI C
  - Python
  - etc.

- Simulation of imported oscilloscope signals
- Waveform trigger caused by external TTL signal (rising edge) for synchronization
- Macro function for execution of automated tests

Waveform Generation

The powerful and easy to use WaveMaster software is unique in world market. Without any knowledge in software development, construction of ordinary and complex waveforms is dead easy.

A graphical waveform editor allows to generate individual curves in a flash. Also with a tabular input all kinds of waveforms can be produced immediately.

The simplicity how fast to import data out of oscilloscopes is amazing. Read in ASCII data files is possible in the same way.

Digital Interface USB

All functionalities of the 4-quadrant amplifiers are available in WaveMaster software for controlling the instruments.

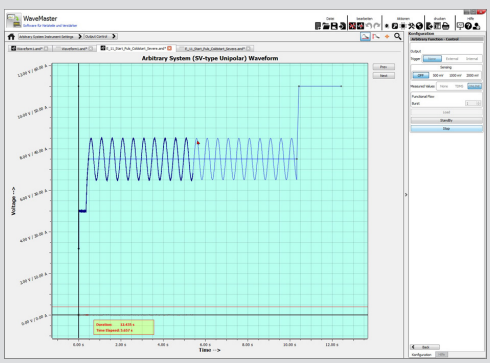
Short time current on/off, output on/off, operating voltage range and other functions can be easily set with its USB interface.

Trigger Function

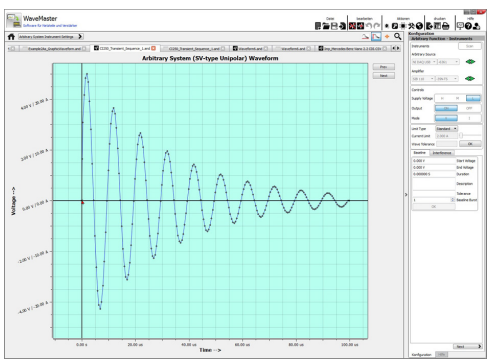
A hardware trigger input can be activate to monitor a TTL input signal on its rising edge. Synchronous waveform simulation, measurement and testing tasks are predestined applications.

Macro Function

With a comfortable macro editor and its execution, selected waveforms run sequentially. Bursts, repetitions and loops make testing easy without any software coding.



Red cursor shows the current position while waveform is running



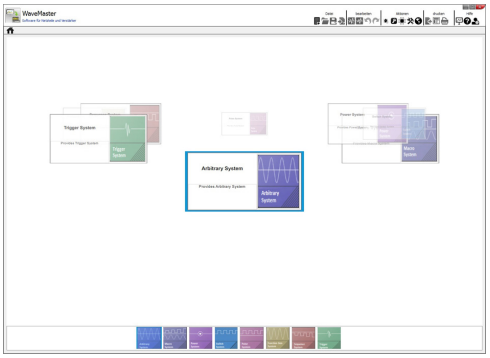
Example out of JLR-EMC-CS CI 250

WaveMaster Remote DLL

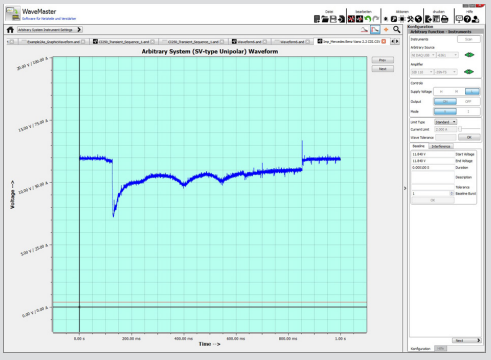
With the WaveMaster remote DLL´s, available for nearly all programming languages, with its command library, users control the 4-quadrant amplifiers in an absolute perfection. There is no need to handle hardware interfaces such as USB or LAN.

One command for each function handles all interfaces. Data files are sent to the instrument within milliseconds. No need to concern about memory space and resolution of the amplifiers.

A simple “load” command calculates the best resolution of the waveform that is possible and sends data to the arbitrary unit. In every DLL (LabView™, Vector CANoe, C#, C++, ANSI C, Python, etc.), commands are identical. This makes switching between programming languages convenient. Commands for creating waveforms out of user programming surroundings are included as well. Variable waveforms for simulation of increasing ramps in time, variation of frequency and many other applications are typical test scenarios.



Starting monitor of WaveMaster

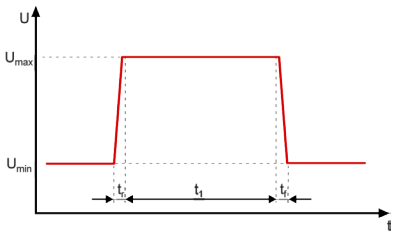


Imported real waveform out of an oscilloscope

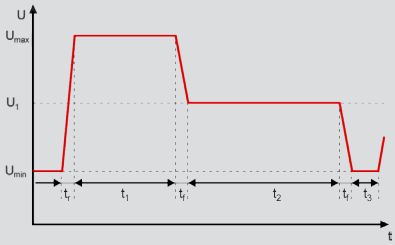
Automotive Standard LV124 (VW80000) E-01 ... E-16

One of the main standards in automotive industries is LV124 / VW80000. With these systems, this standard can be simulated easily. The waveform library contains all electronic waveform tests out of this specification.

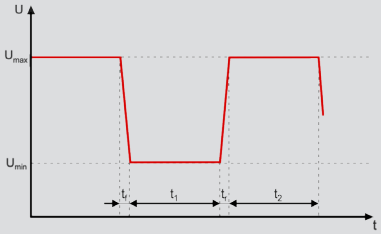
For E-17 ... E-22 please ask for our fully automated Test System



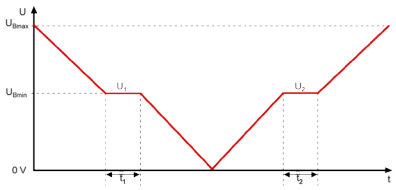
E-01 Long-term overvoltage



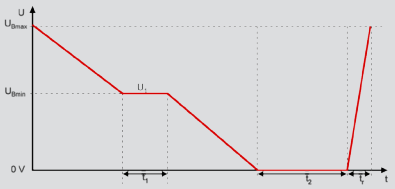
E-02 Transient overvoltage



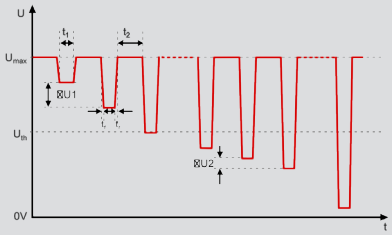
E-03 Transient undervoltage



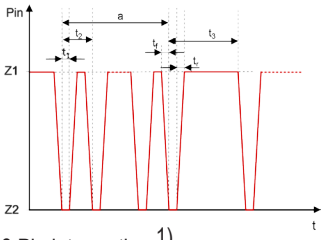
E-07 Slow decrease and increase of the supply voltage



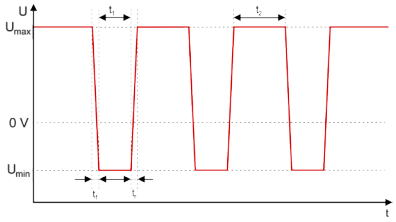
E-08 Slow decrease, quick increase of the supply



E-09 Reset behaviour



E-13 Pin interruption [1]

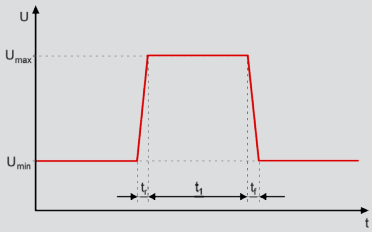


E-15 Reverse polarity (dynamic)

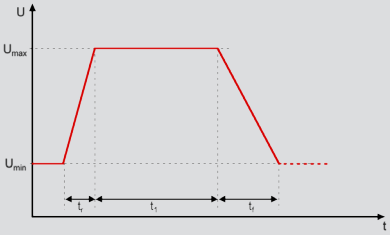
[1] Additional electric switch necessary

[2] Additional power supply necessary

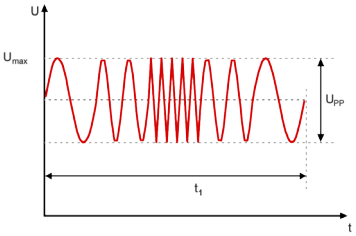
Other Standards Such as LV148, ISO 16750, ISO 7637, DIN 40839, GS 95024, ..., Can Be Simulated Equivalently



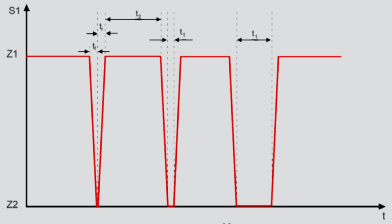
E-04 Jump start



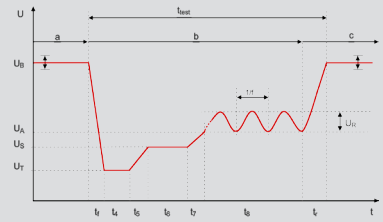
E-05 Load dump



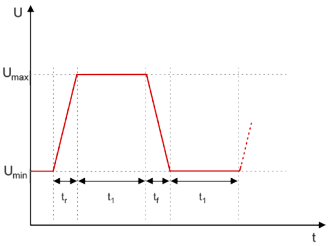
E-06 Superimposed alternating voltage



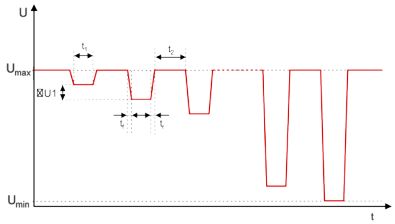
E-10 Short interruptions [1)]



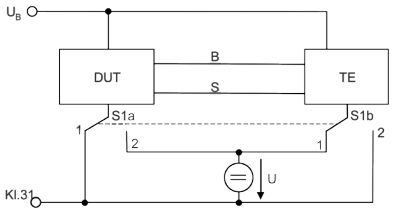
E-11 Start pulses



E-12 Voltage curve with intelligent generator control



E-15 Reverse polarity (static)



E-16 Ground offset [2)]

Vehicle And Avionic Applications

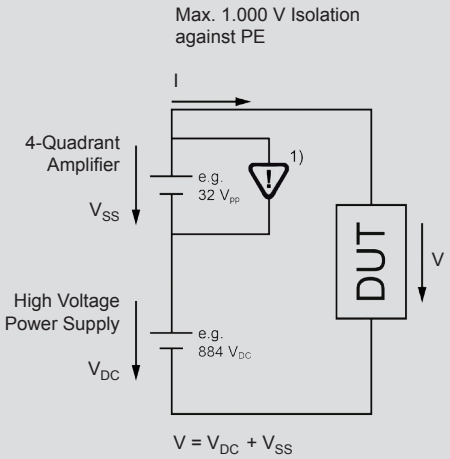
The SIBO arbitrary 4-quadrant amplifiers are predestined to simulate vehicle and avionic standards such as LV 124 / VW 80000, LV148, VDA 320, ISO 7637, DIN 40839, ISO 16750, GS 95024 and many other related norms.

These waveforms and also a wide range of company-specific car manufacturer standards (BMW, Daimler, VW, ...) are included in the standard package.

High Voltage
Superimposed Alternating Voltage
LV123 / HV-09 / VW 80300

The serial operation solution allows to test HV components up to 1000 V DC.
Standards like LV123, ISO 3637-4 and many others can be tested.
With our 4-quadrant amplifier systems, interferences up to 200 kHz with an amplitude of more than 40 V_{pp} are possible.

Our Solution

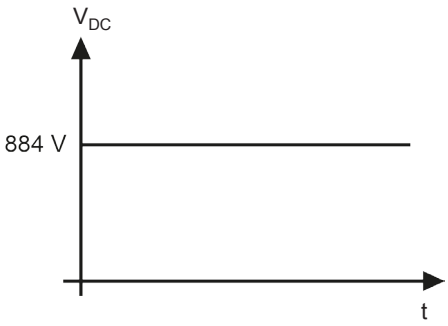


Serial Operation With Applied Voltage Ripple

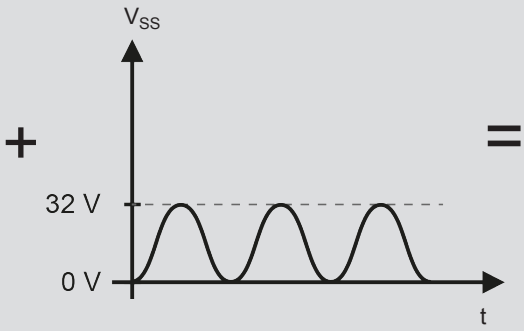
Example:

U_{DC}	= 900 V
U_{SS}	= 32 V_{pp}
f	= 200 kHz
I	= Depending on I_{max} of the 100-TS instrument

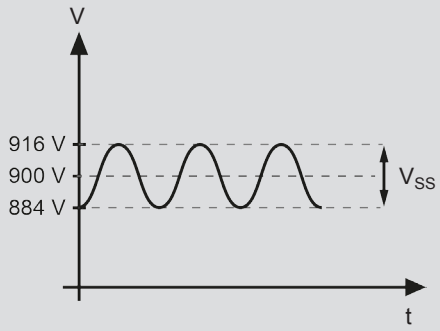
High Voltage Power Supply



4-Quadrant Amplifier



High Voltage Power Supply + 4-Quadrant Amplifier



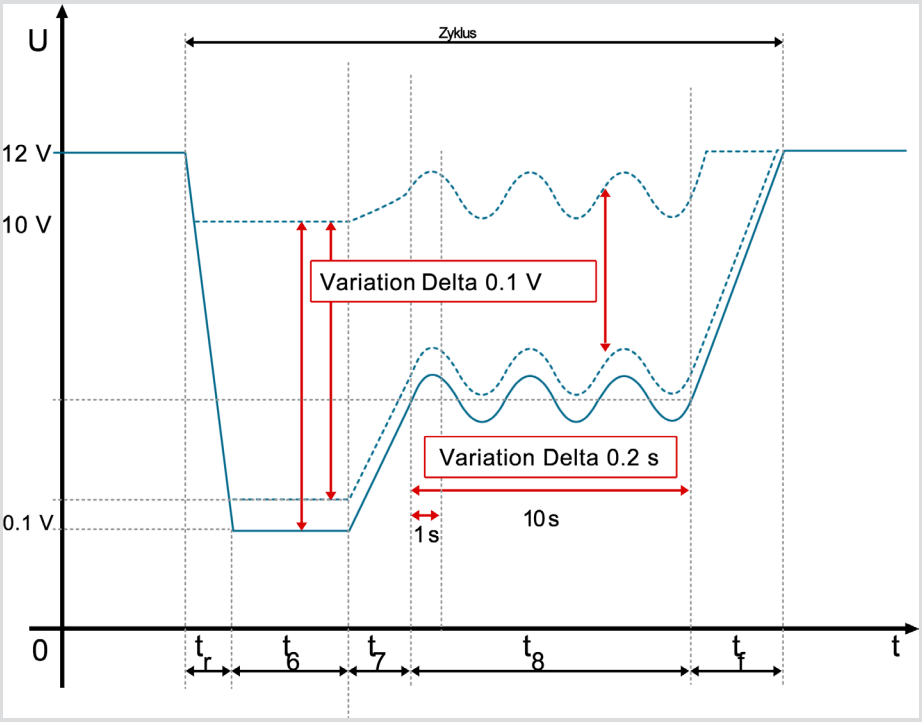
1) Option OVR HV necessary
(Over voltage protection for high voltage power supply in series)

How to define the dimension.
Example:

I = 100 A, V = 450 V, V_{pp} = 20 V
P_{HV} = 450 V · 100 A → P_{HV} ~ 50 KW
P_{4Q} = 20 V · 100 A → P_{4Q} ~ 2 KW
out of the voltage / current graphics and its voltage ranges, we need a 4-quadrant amplifier with approximately 3 KW.

Variable Waveform Generation

Variations In Voltage And Time

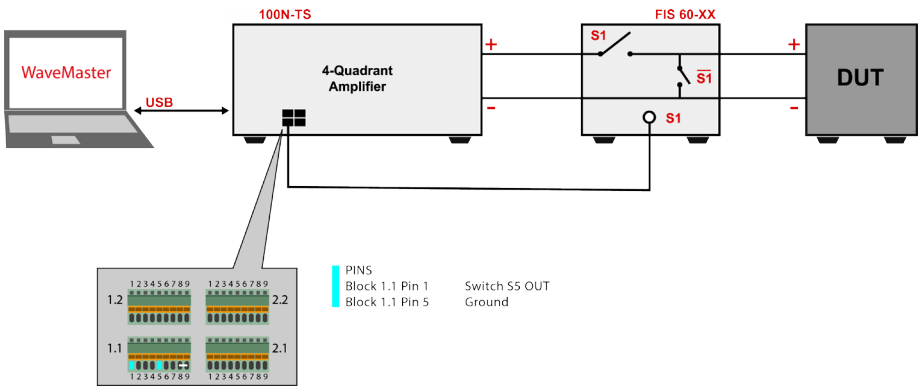


Easy Definition Of Variations

Meanwhile, many car manufacturers extend the standard waveforms with many variable parameters in time and amplitude.

SIBO´s comprehensive WaveMaster Software allows to do these variations easily.

Test System With Electronic Switch



E-10 / E-13 Pulses Out Of LV124

According to LV124, E-10 and E-13 pulses, interruptions need to be implemented. Hereby additional electronic switches are necessary. These switches are controlled by SIBO´s WaveMaster software and the amplifier´s built-in counter outputs.

No additional function generator is necessary. This allows to build up a fully automated HIL test system.

Easy Programming Python

Special Features

- Ready to use for LabView™, Vector CANoe / CAPL, C#, C++, ANSI C, Python, etc.
- Creating waveforms out of source code
- Predefined commands for sine waves, exponential functions, ramps, etc.
- Integration into HIL simulation systems
- Complete interface handling and configuration
- Starting and closing software out of application

Example 1

This programming example in Python opens an existing data file, loads data into amplifiers memory, switches the output on and runs the application in a loop of five times.

```
import WaveMaster_PY27_x32
import time

#Create PYD object
wavemaster = WaveMaster_PY27_x32.CreateObject()
#Connect to the WaveMaster server
serverIPAddress = „10.99.92.78“
serverPortNumber = 700
arbnet.Connect(serverIPAddress,serverPortNumber)

#Open an existing file
fileName = „F:\\Waveform1MV.and“
openfileRet = wavemaster.OpenFile(fileName)

#Arbitrary System Function
sys=WaveMaster.GetArbitrarySystem()
#Configure the device settings
#Define source and amplifier
source = „NI DAQ USB-6259“
amplifier = „SIB 105-75N-TS“
#Set System
setSysRet = sys.Set(1,source,amplifier,0,0,0)
time.sleep(5)
#Load waveform into instruments memory
sys.Load()
#Enable output
sys.Execute()
#Start runnings of waveform with burst=5
sys.Start(5)
#Wait until waveform ends after 5 runnings
run = sys.IsRun()
while run == 1:
     time.sleep(0.5)
     run = sys.IsRun()
#Set output to standby
sys.Standby()

#Close file
openfileRet.Close()
#Disconnect from WaveMaster server
wavemaster.disconnect()
```

C++

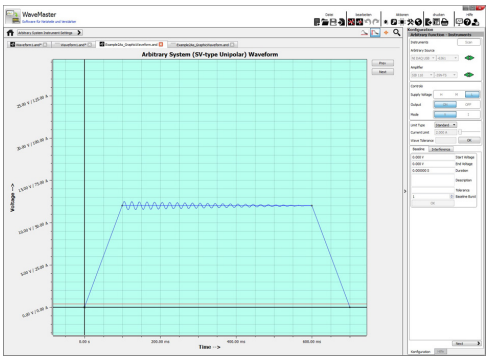
Example 2

Creating waveforms out of customers programming source code is quite easy:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using WaveMaster_CPP_x32;

namespace TestCase2
{
    class Program
    {
        static void Main(string[] args)
        {
            //assuming WaveMaster is started externally in server mode
            RemoteWaveMasterDotNet _dllTest = new RemoteWaveMasterDotNet();
            Resource _sysResource = null;
            Resource _fileResNew = null;

            string ipaddress = „10.99.92.78“;
            int iport = 700;
            int res = -1;
            int layer = 1;
            string source = „NI DAQ USB-6259“;
            string amplifier = „SIB 105-75N-TS“;
            string online = string.Empty;
            string fileName = „F:\\Waveform2MV.and“;
            int fileType = 0x10;
            int run = 0;

            res = _dllTest.Connect(ipaddress, iport);
            Console.WriteLine(„1 - Connected to WaveMaster...“);
            res = _dllTest.NewFile(ref _fileResNew, fileType, fileName);
            if(res == 0)
                Console.WriteLine(„2 - New File created...“);
            res = _dllTest.AddDataFile(_fileResNew,1,0.0,0.0,5.0);
            if(res == 0)
                Console.WriteLine(„ - 1 New value in waveform added...“);
            res = _dllTest.AddDataFile(_fileResNew,1,0.1,12.0,5.0);
            if(res == 0)
                Console.WriteLine(„ - 2 New value in waveform added...“);
            res = _dllTest.AddDataFile(_fileResNew,1,0.5,12.0,5.0,1,50.0,10.0,2.0,0.0,0.0,0);
            if(res == 0)
                Console.WriteLine(„ - 3 Sine interference on waveform added...“);
            res = _dllTest.AddDataFile(_fileResNew,1,1.0,0.0,5.0);
            if(res == 0)
                Console.WriteLine(„ - 4 New value in waveform added...“);
            res = _dllTest.GetArbitrarySystem(out _sysResource);
            if (res == 0)
            {
               Console.WriteLine(„3 - GetArbitrarySystem...“);
               res = _dllTest.SetSystem(_sysResource,ref online,layer,source,amplifier,0,0,0);
               if (res == 0)
               {
                   res = _dllTest.LoadSystem(_sysResource);
                   if (res == 0)
                       Console.WriteLine(„5 - Write Waveform into instruments memory...“);
                   res = _dllTest.ExecuteSystem(_sysResource);
                   if (res == 0)
                       Console.WriteLine(„6 - Switch instruments output on...“);
                   res = _dllTest.StartSystem(_sysResource, 5);
                   if (res == 0)
                       Console.WriteLine(„7 - Run waveform 5 times...“);
                   res = _dllTest.IsRunSystem(_sysResource, out run);
                   if (res == 0)
                       Console.WriteLine(„8 - IsRunSystem...“);
                   while (run == 1)
                   {
                       System.Threading.Thread.Sleep(1000);//1 sec
                       res = _dllTest.IsRunSystem(_sysResource, out run);
                   }
                   res = _dllTest.StandbySystem(_sysResource);
                   if (res == 0)
                       Console.WriteLine(„9 - StandbySystem...“);
               }
            }
            res = _dllTest.SaveFile(_fileResNew,fileName);
            res = _dllTest.CloseFile(_fileResNew);
            res = _dllTest.Disconnect();
        }
    }
}
```

Example 2 As Graphic Waveform

This code in C# generates the following waveform and runs it 5 times.



Technical Data / Order Information 100-35N-TS 35 V / -16 V

Order Information

105-35N-TS	-16 V...+35 V /	20 A /	0,4 kW
110-35N-TS	-16 V...+35 V /	40 A /	1 kW
120-35N-TS	-16 V...+35 V /	76 A /	2 kW
130-35N-TS	-16 V...+35 V /	114 A /	3 kW
140-35N-TS	-16 V...+35 V /	152 A /	4 kW
150-35N-TS	-16 V...+35 V /	190 A /	5 kW
160-35N-TS	-16 V...+35 V /	228 A /	6 kW
180-35N-TS	-16 V...+35 V /	304 A /	8 kW
200-35N-TS	-16 V...+35 V /	380 A /	10 kW
220-35N-TS	-16 V...+35 V /	456 A /	12 kW
250-35N-TS	-16 V...+35 V /	570 A /	15 kW
280-35N-TS	-16 V...+35 V /	684 A /	18 kW

Technical Specifications

Ranges / Current	105-35N-TS	110-35N-TS	120-35N-TS	130-35N-TS	140-35N-TS	150-35N-TS
Low voltage range -16 V...+16 V	15 A	38 A	76 A	114 A	152 A	190 A
Middle voltage range -16 V...+27 V	15 A	38 A	76 A	114 A	152 A	190 A
High voltage range -16 V...+35 V	11 A	28 A	55 A	83 A	110 A	138 A
Current peak 500 ms	2 x I_{MAX}					
Gain (voltage)	1 V / 10 V					
Gain (current)	1 V / 2,5 A	1 V / 10 A	1 V / 100 A			
DC-Offset	< 1 mV					
Monitor output (voltage)	1 V / 10 V					
Monitor output (current)	1 V / 2,5 A	1 V / 10 A	1 V / 100 A			
Residual Noise	< 7 mV					
Source power	400 W	1.000 W	2.000 W	3.000 W	4.000 W	5.000 W
Sink power	140 W	350 W	700 W	1.050 W	1.400 W	1.750 W
Slew rate	100 V / µs		50 V / µs			
CV mode Frequency full range small signal (-3 dB) CC mode Frequency full range small signal (-3 dB)	DC - 1 MHz		DC - 200 kHz DC - 500 kHz Depending on RC network			
Input impedance unbalanced, 1 kHz balanced, 1 kHz	100 k Ω 200 k Ω					
Instrument size	19“, 3 U	19“, 4 U	19“, 12 U	19“, 16 U	19“, 20 U	19“, 24 U
Dimensions WxHxD (cm)						
Delivery	Instrument	Instrument	19“ rack	19“ rack	19“ rack	19“ rack
Weight	20 kg	40 kg	150 kg	190 kg	230 kg	270 kg
Power supply	230 V AC (±10%, 50 Hz ... 60 Hz)		3 x 230 V AC (±10%, 50 Hz ... 60 Hz)			
Protection	10 A		3 x 16 A			
Protective functions	OVT, OCT, OTP					
Operating temperature	10° C - 55° C					

Technical Specifications

Ranges / Current	160-35N-TS	180-35N-TS	200-35N-TS	220-35N-TS	250-35N-TS	280-35N-TS
Low voltage range -16 V...+16 V	228 A	304 A	380 A	456 A	570 A	684 A
Middle voltage range -16 V...+27 V	228 A	304 A	380 A	456 A	570 A	684 A
High voltage range -16 V...+35 V	165 A	220 A	276 A	331 A	413 A	496 A
Current peak 500 ms	2 x I_{MAX}					
Gain (voltage)	1 V / 10 V					
Gain (current)	1 V / 100 A					
DC-Offset	< 1 mV					
Monitor output (voltage)	1 V / 10 V					
Monitor output (current)	1 V / 100 A					
Residual Noise	< 7 mV					
Source power	6.000 W	8.000 W	10.000 W	12.000 W	15.000 W	18.000 W
Sink power	2.100 W	2.800 W	3.500 W	4.200W	5.200 W	6.300 W
Slew rate	50 V / µs					
CV mode Frequency full range small signal (-3 dB) CC mode Frequency full range small signal (-3 dB)	 DC - 200 kHz DC - 500 kHz Depending on RC network					
Input impedance unbalanced, 1 kHz balanced, 1 kHz	 100 k Ω 200 k Ω					
Instrument size	19“, 28 U	2x 19“, 20 U	2 x 19“, 24 U	2 x 19“, 28 U	3 x 19“, 24 U	3 x 19“, 28 U
Dimensions WxHxD (cm)						
Delivery	19“ rack	2 x 19“ rack	2 x 19“ rack	2 x 19“ rack	3 x 19“ rack	3 x 19“ rack
Weight	310 kg	2 x 230 kg	2 x 270 kg	2 x 310 kg	2 x 270 kg	2 x 310 kg
Power supply	3 x 230 V AC (±10%, 50 Hz ... 60 Hz)					
Protection	3 x 16 A					
Protective functions	OVT, OCT, OTP					
Operating temperature	10° C - 55° C					

Options

100S	Sensing (0 V / 0,5 V / 1 V / 2 V) standard in systems > 1 KW
100I3	3-channel isolation amplifier
100VR	Variable internal resistor 0...200 mΩ
100CS200	Current sensor (standard in systems > 1 KW)
OVR HV	Over voltage protection for high voltage power supply in series
100K	Compensation network to run as current amplifier
100MW3	19” Adapter for 3U systems
100MW4	19” Adapter for 4U systems
FIS 60-75	Electronic switch (60 V / 75 A)
FIS 60-125	Electronic switch (60 V / 125 A)
FIS 60-CS	Cable Set for electronic switch
FIS 60-RR	Reference resistors (1Ω / 100Ω / 1kΩ)
700-XX	19” rack

Technical Data / Order Information 100-70N-TS 70 V / -16 V

Order Information

105-70N-TS	-16 V...+70 V /	20 A /	0,5 kW
110-70N-TS	-16 V...+70 V /	40 A /	1 kW
120-70N-TS	-16 V...+70 V /	76 A /	2 kW
130-70N-TS	-16 V...+70 V /	114 A /	3 kW
140-70N-TS	-16 V...+70 V /	152 A /	4 kW
150-70N-TS	-16 V...+70 V /	190 A /	5 kW
160-70N-TS	-16 V...+70 V /	228 A /	6 kW
180-70N-TS	-16 V...+70 V /	304 A /	8 kW
200-70N-TS	-16 V...+70 V /	380 A /	10 kW
220-70N-TS	-16 V...+70 V /	456 A /	12 kW
250-70N-TS	-16 V...+70 V /	570 A /	15 kW
280-70N-TS	-16 V...+70 V /	684 A /	18 kW

Technical Specifications

Ranges / Current	105-70N-TS	110-70N-TS	120-70N-TS	130-70N-TS	140-70N-TS	150-70N-TS
Low voltage range -16 V...+16 V	19 A	38 A	76 A	114 A	152 A	190 A
Middle voltage range -16 V...+27 V	19 A	38 A	76 A	114 A	152 A	190 A
High voltage range -16 V...+70 V	7 A	14 A	29 A	43 A	57 A	71 A
Current peak 500 ms	2 x I_{MAX}					
Gain (voltage)	1 V / 10 V					
Gain (current)	1 V / 2,5 A	1 V / 10 A	1 V / 100 A			
DC-Offset	< 1 mV					
Monitor output (voltage)	1 V / 10 V					
Monitor output (current)	1 V / 2,5 A	1 V / 10 A	1 V / 100 A			
Residual Noise	< 7 mV					
Source power	500 W	1.000 W	2.000 W	3.000 W	4.000 W	5.000 W
Sink power	240 W	470 W	940 W	1.400 W	1.800 W	2.400 W
Slew rate	100 V / µs		50 V / µs			
CV mode Frequency full range small signal (-3 dB) CC mode Frequency full range small signal (-3 dB)	DC - 1 MHz		DC - 200 kHz DC - 500 kHz Depending on RC network			
Input impedance unbalanced, 1 kHz balanced, 1 kHz	100 k Ω 200 k Ω					
Instrument size	19“, 3 U	19“, 4 U	19“, 12 U	19“, 16 U	19“, 20 U	19“, 24 U
Dimensions WxHxD (cm)						
Delivery	Instrument	Instrument	19“ rack	19“ rack	19“ rack	19“ rack
Weight	20 kg	40 kg	150 kg	190 kg	230 kg	270 kg
Power supply	230 V AC (±10%, 50 Hz ... 60 Hz)		3 x 230 V AC (±10%, 50 Hz ... 60 Hz)			
Protection	10 A		3 x 16 A			
Protective functions	OVT, OCT, OTP					
Operating temperature	10° C - 55° C					

Technical Specifications

Ranges / Current	160-70N-TS	180-70N-TS	200-70N-TS	220-70N-TS	250-70N-TS	280-70N-TS
Low voltage range -16 V...+16 V	228 A	304 A	380 A	456 A	570 A	684 A
Middle voltage range -16 V...+27 V	228 A	304 A	380 A	456 A	570 A	684 A
High voltage range -16 V...+70 V	86 A	114 A	143 A	171 A	214 A	257 A
Current peak 500 ms	2 x I_{MAX}					
Gain (voltage)	1 V / 10 V					
Gain (current)	1 V / 100 A					
DC-Offset	< 1 mV					
Monitor output (voltage)	1 V / 10 V					
Monitor output (current)	1 V / 100 A					
Residual Noise	< 7 mV					
Source power	6.000 W	8.000 W	10.000 W	12.000 W	15.000 W	18.000 W
Sink power	2.800 W	3.800 W	4.700 W	5.600 W	7.000 W	8.400 W
Slew rate	50 V / µs					
CV mode Frequency full range small signal (-3 dB) CC mode Frequency full range small signal (-3 dB)	 DC - 200 kHz DC - 500 kHz Depending on RC network					
Input impedance unbalanced, 1 kHz balanced, 1 kHz	 100 k Ω 200 k Ω					
Instrument size	19“, 28 U	2x 19“, 20 U	2 x 19“, 24 U	2 x 19“, 28 U	3 x 19“, 24 U	3 x 19“, 28 U
Dimensions WxHxD (cm)						
Delivery	19“ rack	2 x 19“ rack	2 x 19“ rack	2 x 19“ rack	3 x 19“ rack	3 x 19“ rack
Weight	310 kg	2 x 230 kg	2 x 270 kg	2 x 310 kg	2 x 270 kg	2 x 310 kg
Power supply	3 x 230 V AC (±10%, 50 Hz ... 60 Hz)					
Protection	3 x 16 A					
Protective functions	OVT, OCT, OTP					
Operating temperature	10° C - 55° C					

Options

100S	Sensing (0 V / 0,5 V / 1 V / 2 V) standard in systems > 1 KW
100I3	3-channel isolation amplifier
100VR	Variable internal resistor 0...200 mΩ
100CS200	Current sensor (standard in systems > 1 KW)
OVR HV	Over voltage protection for high voltage power supply in series
100K	Compensation network to run as current amplifier
100MW3	19” Adapter for 3U systems
100MW4	19” Adapter for 4U systems
FIS 60-75	Electronic switch (60 V / 75 A)
FIS 60-125	Electronic switch (60 V / 125 A)
FIS 60-CS	Cable Set for electronic switch
FIS 60-RR	Reference resistors (1Ω / 100Ω / 1kΩ)
700-XX	19” rack

Technical Data / Order Information 100-75N-TS 75 V / -75 V

Order Information

105-75N-TS	-75 V...+75 V /	20 A /	0,5 kW
110-75N-TS	-75 V...+75 V /	40 A /	1 kW
120-75N-TS	-75 V...+75 V /	76 A /	2 kW
130-75N-TS	-75 V...+75 V /	114 A /	3 kW
140-75N-TS	-75 V...+75 V /	152 A /	4 kW
150-75N-TS	-75 V...+75 V /	190 A /	5 kW
160-75N-TS	-75 V...+75 V /	228 A /	6 kW
180-75N-TS	-75 V...+75 V /	304 A /	8 kW
200-75N-TS	-75 V...+75 V /	380 A /	10 kW
220-75N-TS	-75 V...+75 V /	456 A /	12 kW
250-75N-TS	-75 V...+75 V /	570 A /	15 kW
280-75N-TS	-75 V...+75 V /	684 A /	18 kW

Technical Specifications

Ranges / Current	105-75N-TS	110-75N-TS	120-75N-TS	130-75N-TS	140-75N-TS	150-75N-TS
Low voltage range -25 V...+25 V	19 A	38 A	76 A	114 A	152 A	190 A
Middle voltage range -50 V...+50 V	10 A	19 A	38 A	57 A	76 A	95 A
High voltage range -75 V...+75 V	7 A	14 A	27 A	40 A	53 A	67 A
Current peak 500 ms	2 x I_{MAX}					
Gain (voltage)	1 V / 10 V					
Gain (current)	1 V / 2,5 A	1 V / 10 A	1 V / 100 A			
DC-Offset	< 1 mV					
Monitor output (voltage)	1 V / 10 V					
Monitor output (current)	1 V / 2,5 A	1 V / 10 A	1 V / 100 A			
Residual Noise	< 7 mV					
Source power	500 W	1.000 W	2.000 W	3.000 W	4.000 W	5.000 W
Sink power	500 W	1.000 W	2.000 W	3.000 W	4.000 W	5.000 W
Slew rate	100 V / µs		50 V / µs			
CV mode Frequency full range small signal (-3 dB)	DC - 1 MHz		DC - 200 kHz DC - 500 kHz			
CC mode Frequency full range small signal (-3 dB)	Depending on RC network					
Input impedance unbalanced, 1 kHz balanced, 1 kHz	100 k Ω 200 k Ω					
Instrument size	19“, 3 U	19“, 4 U	19“, 12 U	19“, 16 U	19“, 20 U	19“, 24 U
Dimensions WxHxD (cm)						
Delivery	Instrument	Instrument	19“ rack	19“ rack	19“ rack	19“ rack
Weight	20 kg	40 kg	150 kg	190 kg	230 kg	270 kg
Power supply	230 V AC (±10%, 50 Hz ... 60 Hz)		3 x 230 V AC (±10%, 50 Hz ... 60 Hz)			
Protection	10 A		3 x 16 A			
Protective functions	OVT, OCT, OTP					
Operating temperature	10° C - 55° C					

Technical Specifications

Ranges / Current	160-75N-TS	180-75N-TS	200-75N-TS	220-75N-TS	250-75N-TS	280-75N-TS
Low voltage range -25 V...+25 V	228 A	304 A	380 A	456 A	570 A	684 A
Middle voltage range -50 V...+50 V	114 A	152 A	190 A	228 A	285 A	342 A
High voltage range -75 V...+75 V	80 A	106 A	133 A	160 A	200 A	240 A
Current peak 500 ms	2 x I_{MAX}					
Gain (voltage)	1 V / 10 V					
Gain (current)	1 V / 100 A					
DC-Offset	< 1 mV					
Monitor output (voltage)	1 V / 10 V					
Monitor output (current)	1 V / 100 A					
Residual Noise	< 7 mV					
Source power	6.000 W	8.000 W	10.000 W	12.000 W	15.000 W	18.000 W
Sink power	6.000 W	8.000 W	10.000 W	12.000 W	15.000 W	18.000 W
Slew rate	50 V / µs					
CV mode Frequency full range small signal (-3 dB) CC mode Frequency full range small signal (-3 dB)	DC - 200 kHz DC - 500 kHz Depending on RC network					
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FIS 60-RR	Reference resistors (1Ω / 100Ω / 1kΩ)
700-XX	19” rack

Scope Of Supply

Amplifier system

Power cord

User manual

WaveMaster software

WaveMaster remote DLL´s

Waveform library

19” rack (systems > 1 KW)

BOLAB SYSTEMS GMBH

11/2018 · Subject to change

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