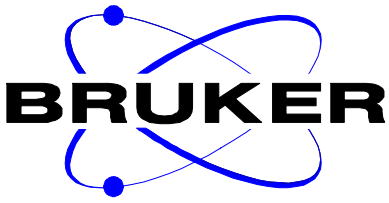


# BLARH100

## Amplifier 900MHz
## User Manual

**Version 001**

**BRUKER**

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Manual P/N: Z31593
DWG-Nr: 1305001

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# General description 1

## Introduction 1.1

The BLAH100 / 900MHz (P/N:W1345047) is a linear pulse amplifier specifically designed for Nuclear Magnetic Resonance (NMR) applications.

It is a class AB linear amplifier and provides a 100W peak power outputs over the frequency range 850-900MHz.

A low power output of 10W peak power over the range 850-900MHz is provided at the 19F output.

An input is provided for the X amplifier to switch the 1H/19F/X channels to a QNP probe.

The amplifier is realised by employing N-CHANNEL MOS BROADBAND RF POWER FETs of the latest generation. The unit can provide full power for any combination of pulse width of 100ms and duty cycle up 10%. Its built-in protection circuitry may allow lower limitations.

An electronic protection circuitry has been designed to protect against:

- Excessive power output level (overdrive)
- Excessive pulse repetition rate (over duty-cycle protection)
- Excessive pulse width (over pulse-width)
- More than 50% reflected RF power (mismatch ≥ 6)
- Thermal overload (overheat)

The amplifier is powered by an internal Switched power supply assembly that provides the 28VDC for the power amplifiers, in addition to all low level voltages for the system.

The supply is auto-protected for overcurrent and overvoltage.

The entire unit is housed in a 19", 4U, 520mm rack cabinet.

## System Check 1.2

Before applying power for the first time the following items should be checked :

- The AC input voltage from the Amplifier must be compatible with 176 to 264 VAC range.
- External blanking ( gating ) pulses must be supplied to the amplifier at the BLK input and with the proper level and logic polarity.
- The Amplifier has a nominal input level of +4dBm. Ensure that the system drivers are operating at these levels.

## *Initial Turn On Procedure* *1.3*

The following list describes how to turn on the Amplifier and what should be seen as this occurs.

Before starting this procedure, make sure that you have properly followed instructions in the "System Check" section.

1. Connect the amplifier to the AC line and turn the circuit breaker on the front panel, to ON.
2. Observe the display on the front panel :
   The +30V, +15V, -15V and +5V display LEDs must be lighted.
3. System is now fully operational.

# Safety 2

## Labels 2.1

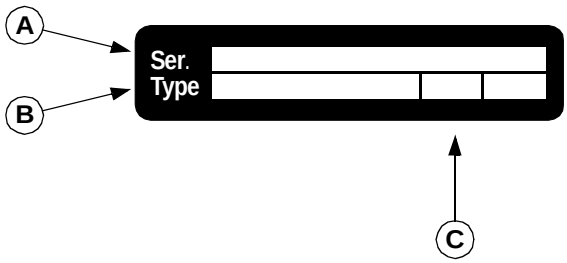
Labels are provided to alert operating and service personnel to conditions that may cause personal injury or damage to the equipment from misuse or abuse. Please read the labels and understand their meaning.

### Dangerous Area 2.1.1

**WARNING** ! High Voltage.


### Name Plate 2.1.2

The Amplifier BLARH100 can be identified by a name plate at the front panel of the unit which has information as follows :




- **(A) Ser.**
  This line contains an assembly number which identifies the Part and the Serial number of the product.
- **(B) Type**
  This line contains the designation of the product.
- **(C) Revision**
  This cell indicates the revision number which identifies the product configuration. The initial revision is 00.

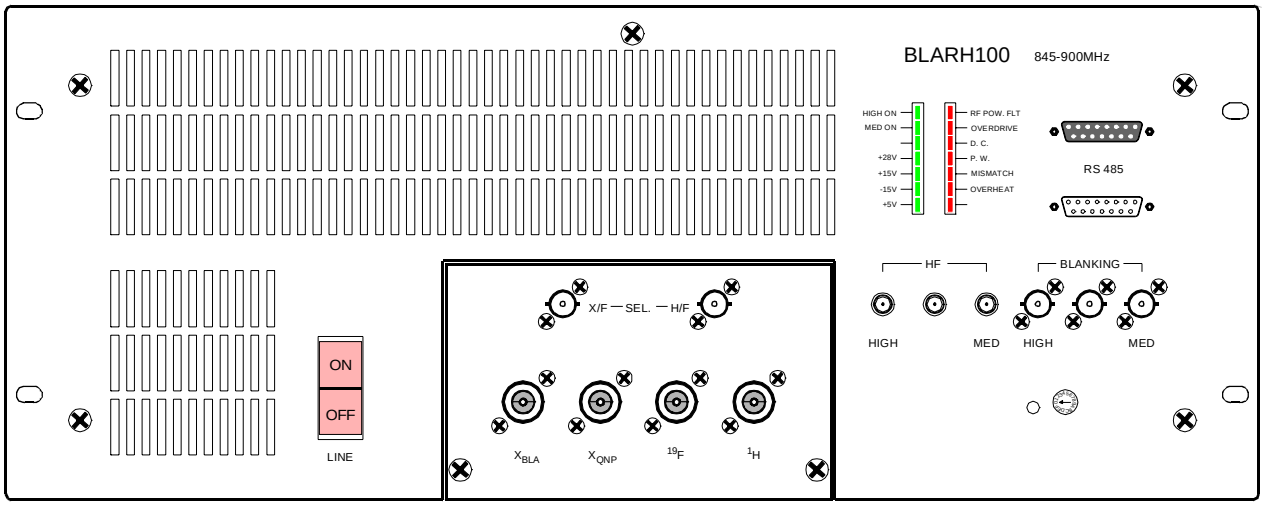
# BLARH100 Operation

# 3

## Front Panel 3.1

The BLARH100 / 900MHz front panel is fitted with a display for status monitoring, two RS485 interface connectors and the RF connectors.

*Figure 3.1. The BLAH100 / 900MHz Front Panel Design*



### *Display* *3.1.1*

*Table 3.1. Indicators*

| | |
|---|---|
| +28V on | Indicates that the 28V supply is correct. |
| +15V on | Indicates that the +15V supply is correct. |
| -15V on | Indicates that the -15V supply is correct. |
| +5V on | Indicates that the +5V supply is correct. |
| Overdrive on | Indicates when the power limit has been reached. |
| Duty Cycle on | Indicates when the duty cycle limit has been reached. |
| Pulse Width on | Indicates when the pulse width limit has been reached. |
| Mismatch on | Indicates when the max. reflected power limit has been reached |
| RF Power FLT on | Lights ON when one of the above limits has been reached. |
| Overheat on | Indicates that the thermistor located on the RF Module heat-sink has sensed excessive temperature or ventilation is stopped .All gatings are locked on the amplifier until the unit cools. |
| High on | The 100W high power amplifier send RF pulse. |
| Med on | The 10W low power amplifier send RF pulse. |

### *RF Connectors* *3.1.2*

*Table 3.2. Connectors*

| | |
|---|---|
| HHigh in | RF in SMA type connectors (female).<br>+4dBm drive for nominal power (100W). |
| HMed in | RF in SMA type connectors (female).<br>+4dBm drive for nominal power (10W). |
| BLNK Med in | Blanking signals BNC type connector (female).<br>TTL logic, 5V = blanking , 0V = unblanking.<br>(When BLANKING, no RF Power). |
| BLNK High in | Blanking signals BNC type connector (female).<br>TTL logic, 5V = blanking , 0V = unblanking.<br>(When BLANKING, no RF Power). |
| X in | RF INPUT for X amplifier. N type connectors (female). |
| QNP/19F/1H out | RF OUT 1H/19F/QNP. N type connectors (female). |

### *Interface Connectors RS485* *3.1.3*

The Control I/O interface connections are 15 pins, D shape sub-miniature type connectors mounted on the SBS BUS Controller.

**SBS BUS = Serial Bruker Spectrospin Bus**

The following table shows the pinout of the master and slave connectors.

*Table 3.3. RS485 pinout*

| | |
|---|---|
| Pin 1 | Shield |
| Pin 2 | Transmit data line + |
| Pin 3 | Wake up line /WUP |
| Pin 4 | Receive data line + |
| Pin 5 | NC |
| Pin 6 | GND |
| Pin 7 | GND |
| Pin 8 | GND |
| Pin 9 | Transmit data line - |
| Pin 10 | NC |
| Pin 11 | Receive data line - |
| Pin 12 | NC |
| Pin 13 | VRS ( +12V ) |
| Pin 14 | VRS ( +12V ) |
| Pin 15 | VRS ( +12V ) |

## *Rear Panel* *3.2*

The rear Panel of the BLAH100 900MHz Amplifier is free of elements in exception of the three pole ( 2P + E ) line filter socket.

# General Information 4

## Amplifiers 4.1

The BLAH100 900MHz amplifier P/N:W1345047, provides a high power outputs at nominal 100W in the frequency range of 850-900MHz.

The RF section of the system consists of a linear preamplifier of about 10W wich drive a median stage of 40W and finaly the output push-pull of 150W.

The linear gain of the amplifier is about 50dB.

The linear amplifier is a class AB with the all stages blancked with the Blanking High signal on the transistor gates.

It can deliver a CW power of 25W max.

The second amplifier is a 10W push-pull in the frequency range of 850-900MHz.

The linear gain is about 38 dB.

The linear amplifier is a class AB with all stages blancked with the Blanking Med signal on the transistor gates.

It can deliver a CW power of 10W max.

## Switchs and detection 4.2

A fast pin diode switch allow to control the output witch get the 100W or the 10W power.(1H/19F)

A slow relais control the output witch get the X Input or the 1H/19F output. Before going to the outputs the RF signals are detected in two bidirectional coplers to get an image of the output RF pulse amplitude for reflected and forward waves.

## Control Board 4.3

The BLA Control Board consists of circuitry for monitoring the output power of the amplifier wich is detected in the bi-directional coupler, and to condition the input blanking ( gating ) signals and deliver them to the amplifiers.

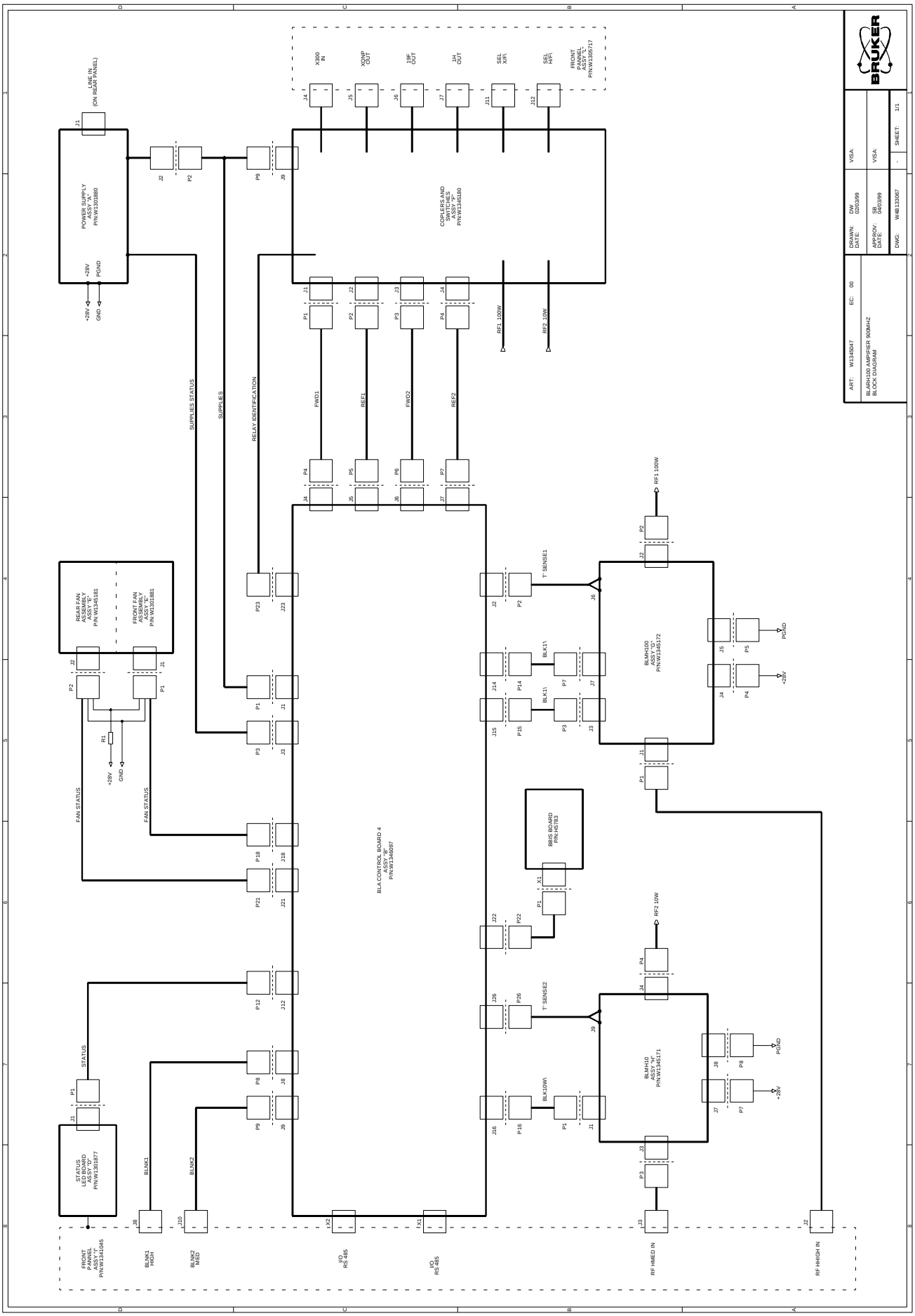
The monitoring is effective on overstress in peak power, average power versus duty cycle and pulse width, so as reflected power,but also for heatsink temperature to protect against thermal overstress and power supplys monitoring or fans defaults.

In case of default the gating signals are disabled, and the corresponding default status display on the front panel is on.

All these informations are also sended to the CPU via the RS485 interface.

# *Amplifier diagrams* 5

*Figure 5.1. BLAXH100 Amplifier 900MHz*



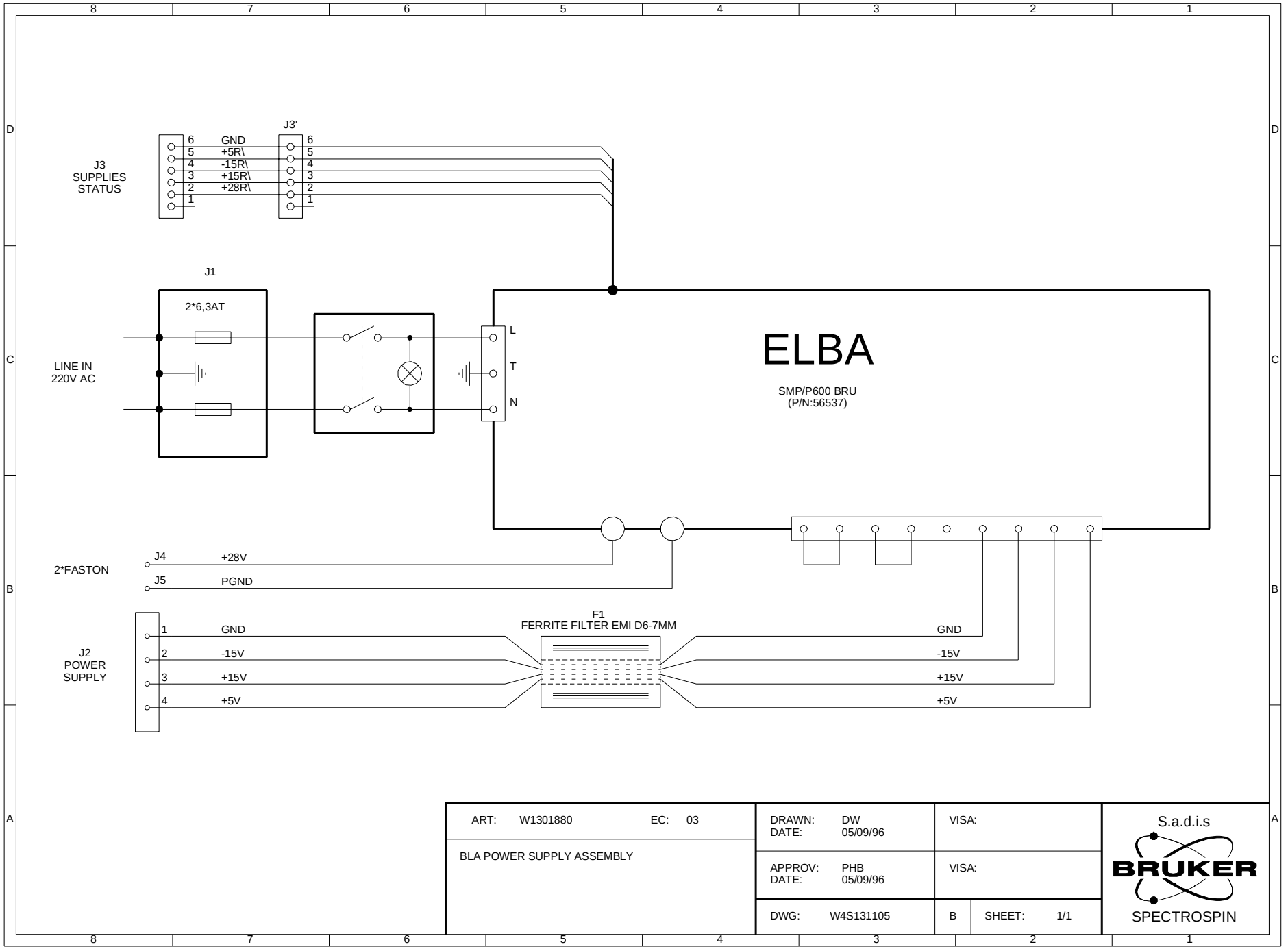
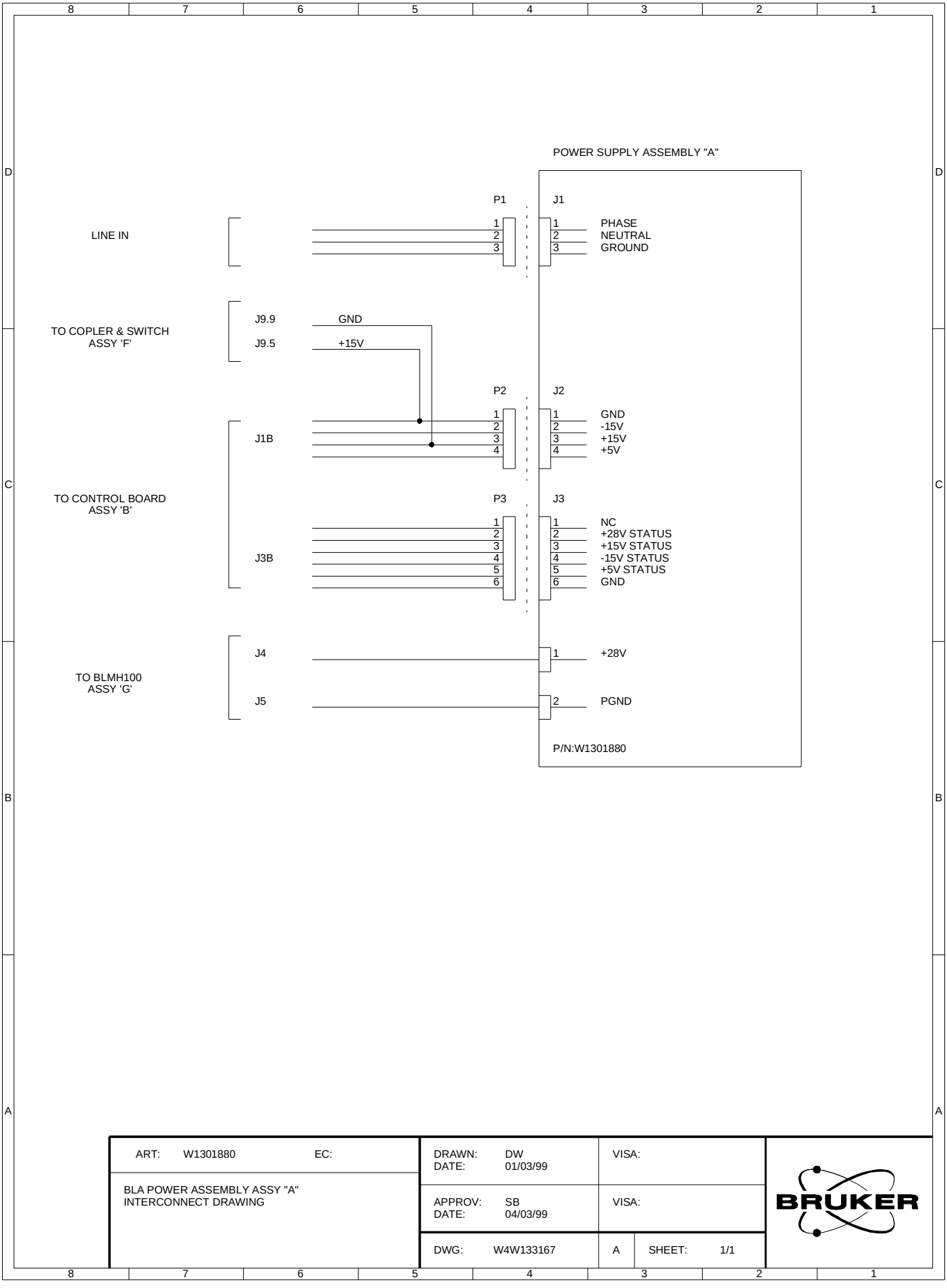


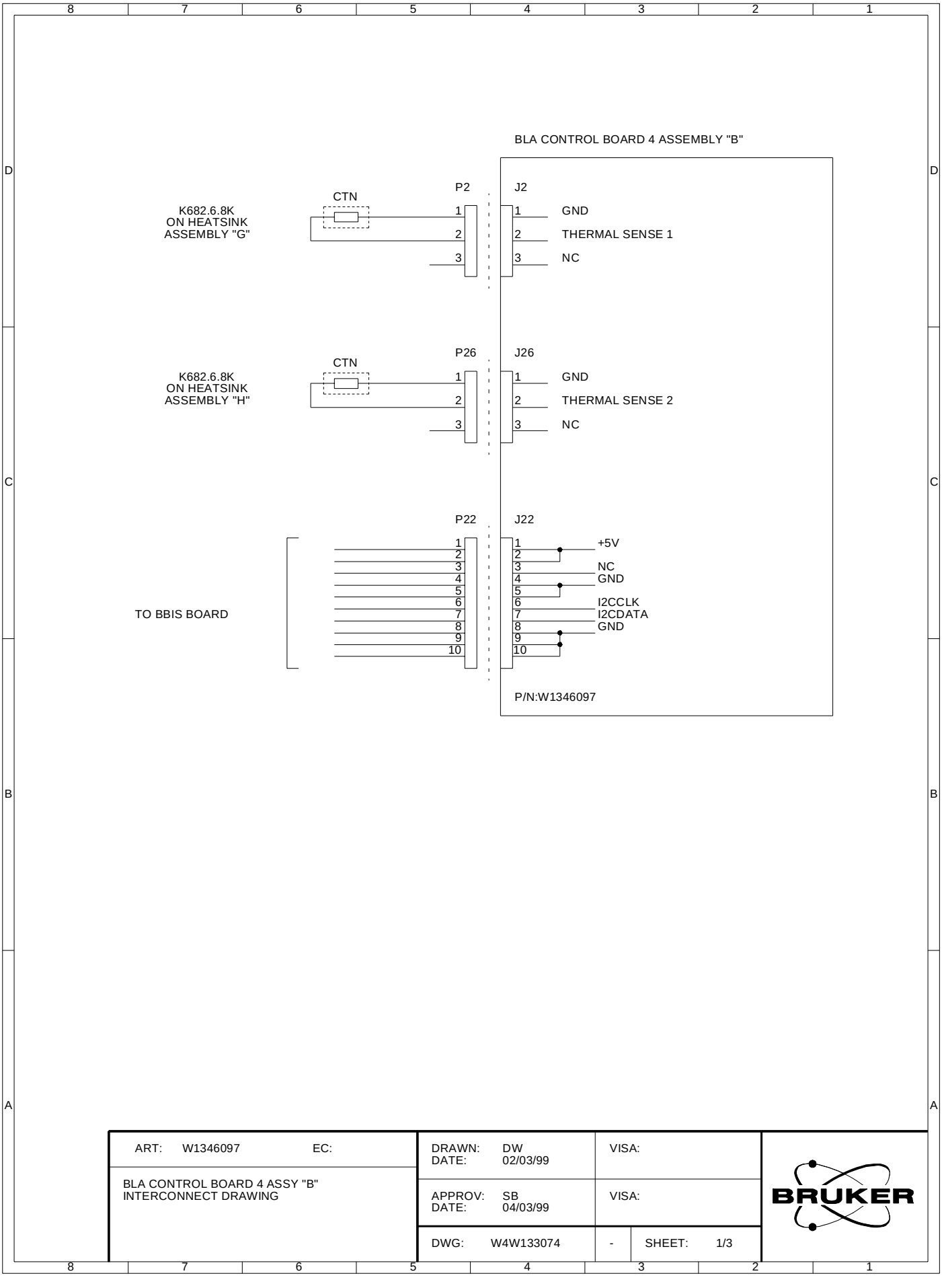

*Figure 5.2. BLA Power Supply*

*Figure 5.3. BLA Power Supply Interconnect Drawing*




| | | | |
|---|---|---|---|
| ART: W1301880 EC: | DRAWN: DW<br>DATE: 01/03/99 | VISA: | |
| BLA POWER ASSEMBLY ASSY "A"<br>INTERCONNECT DRAWING | APPROV: SB<br>DATE: 04/03/99 | VISA: | |
| | DWG: W4W133167 | A | SHEET: 1/1 |

*Figure 5.4. BLA Control Board 4 Interconnect Drawing 1*




| | | | |
|---|---|---|---|
| ART: W1346097 EC: | DRAWN: DW<br>DATE: 02/03/99 | VISA: | |
| BLA CONTROL BOARD 4 ASSY "B"<br>INTERCONNECT DRAWING | APPROV: SB<br>DATE: 04/03/99 | VISA: | |
| | DWG: W4W133074 | - | SHEET: 1/3 |

*Figure 5.5. BLA Control Board 4 Interconnect Drawing 2*

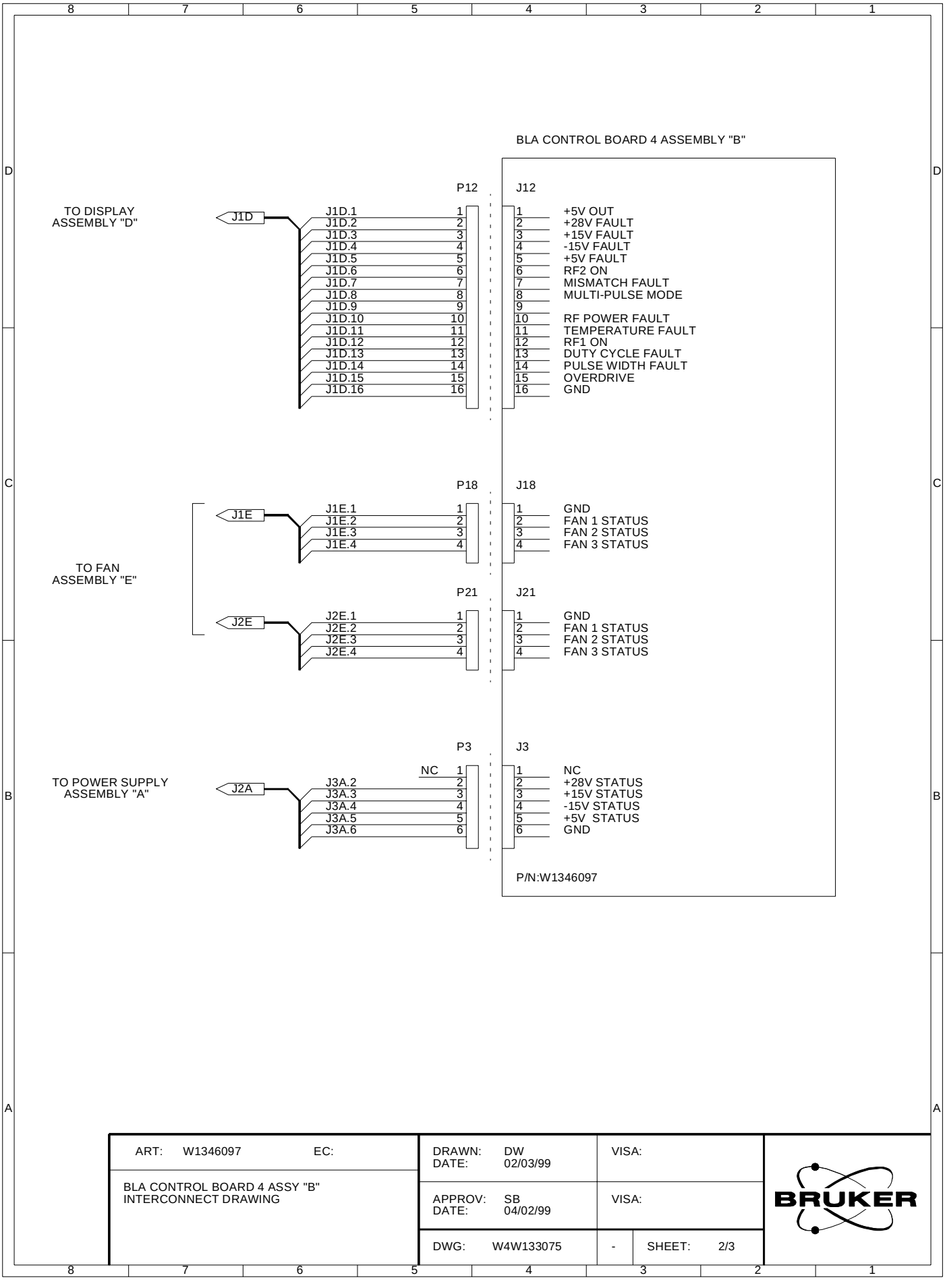


*Figure 5.6. BLA Control Board 4 Interconnect Drawing 3*

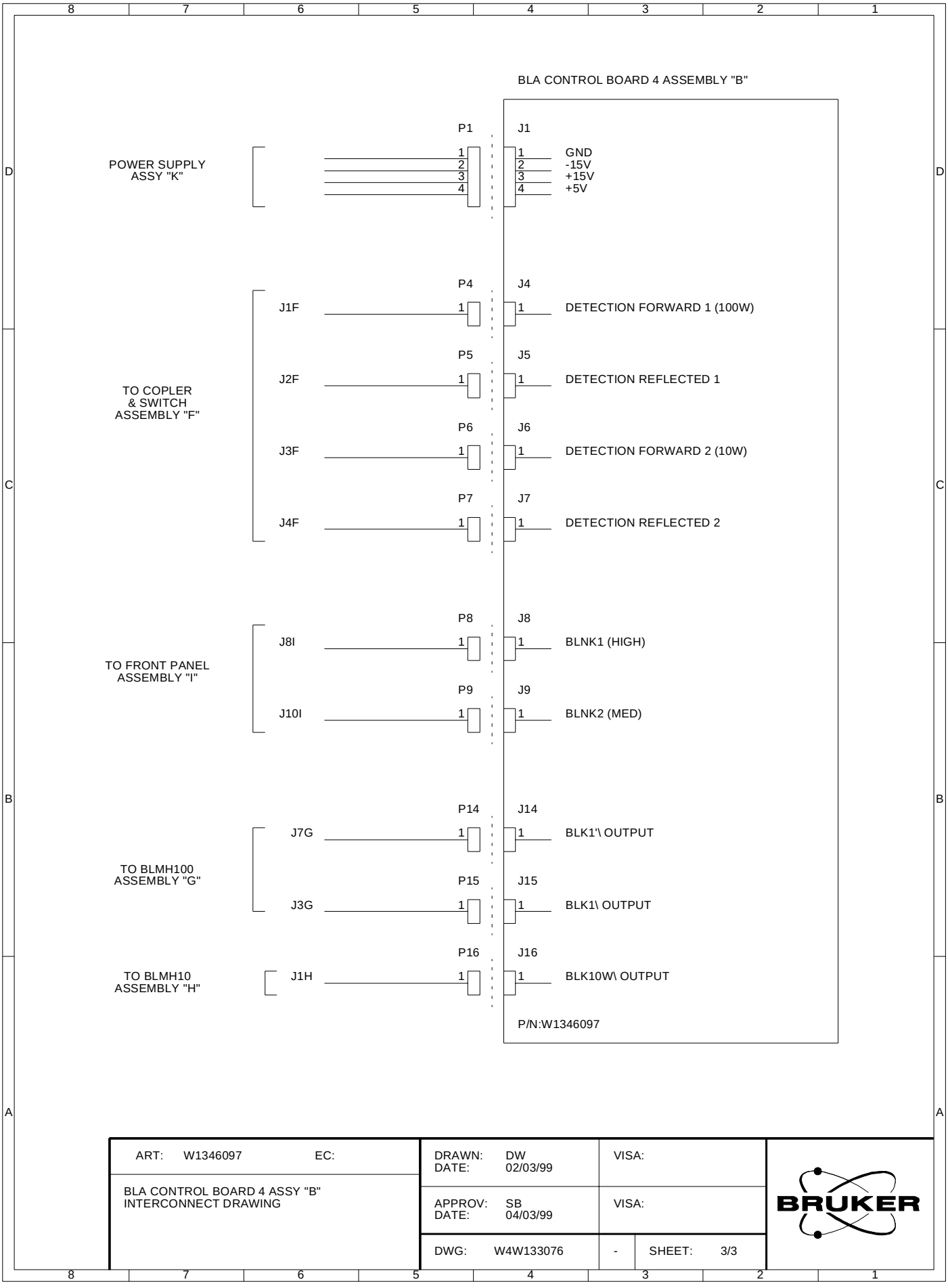


*Figure 5.7. Universal BBIS Board Interconnect Drawing*

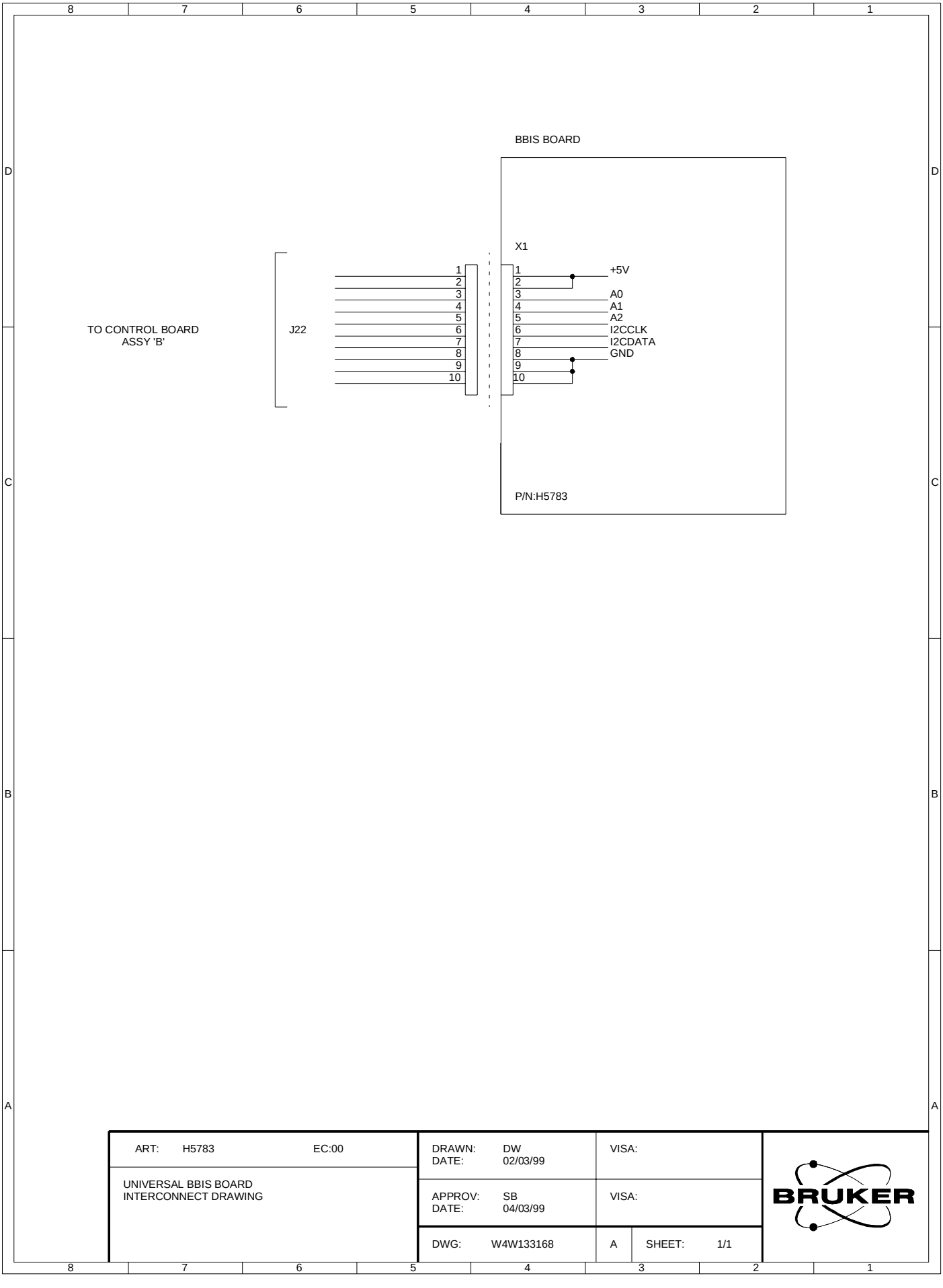


*Figure 5.8. BLA Status Led Board Interconnect Drawing*

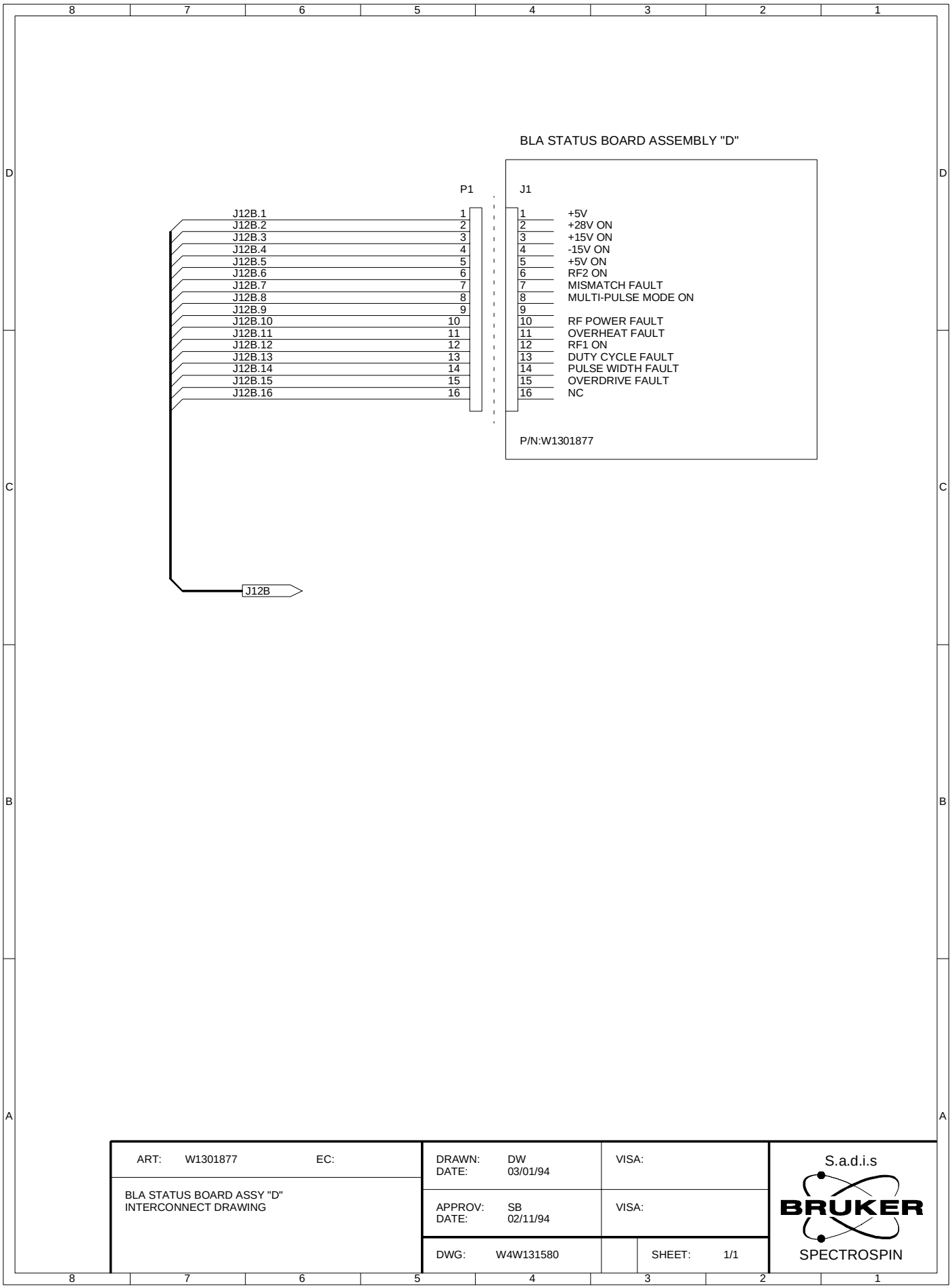
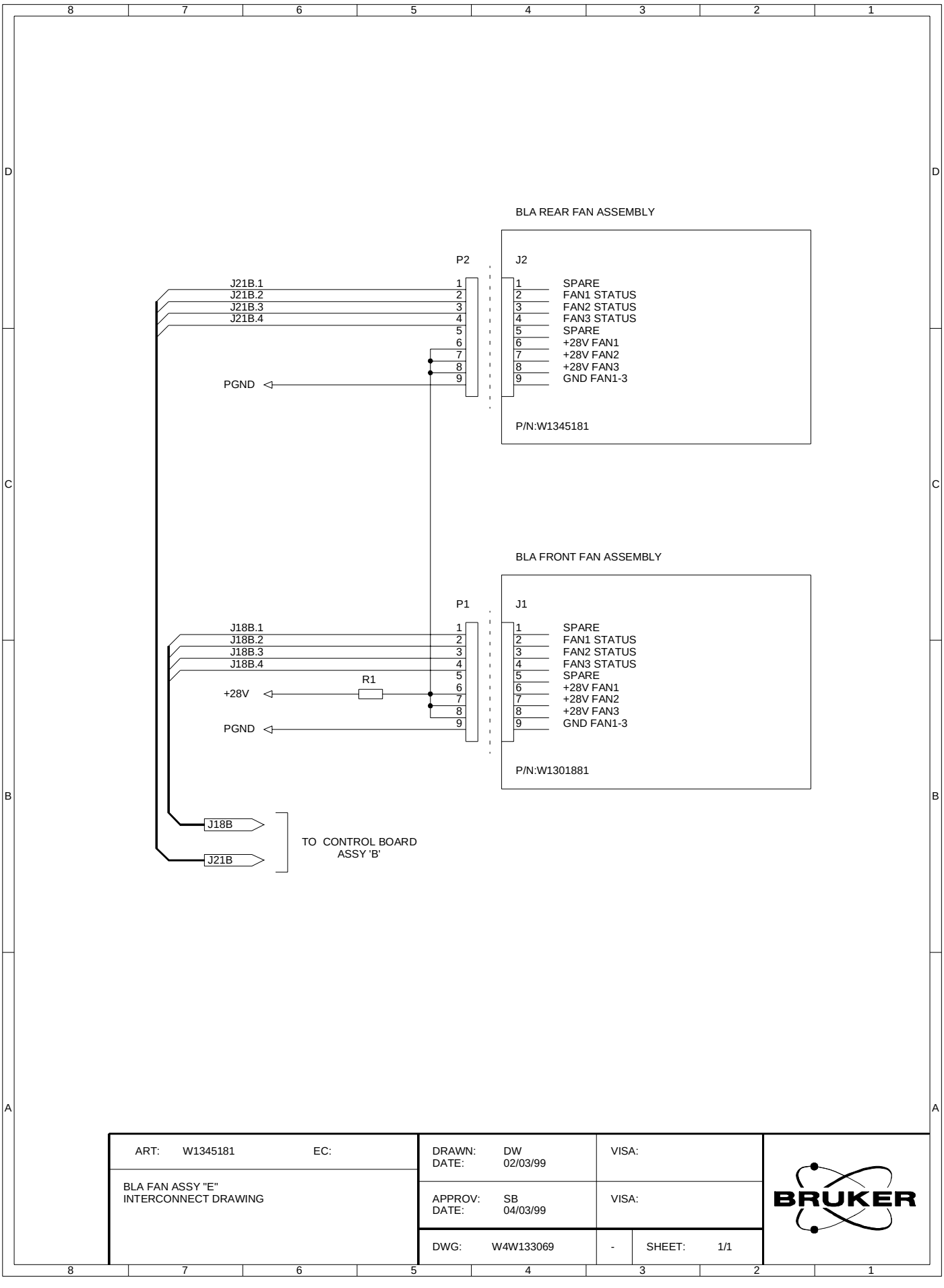
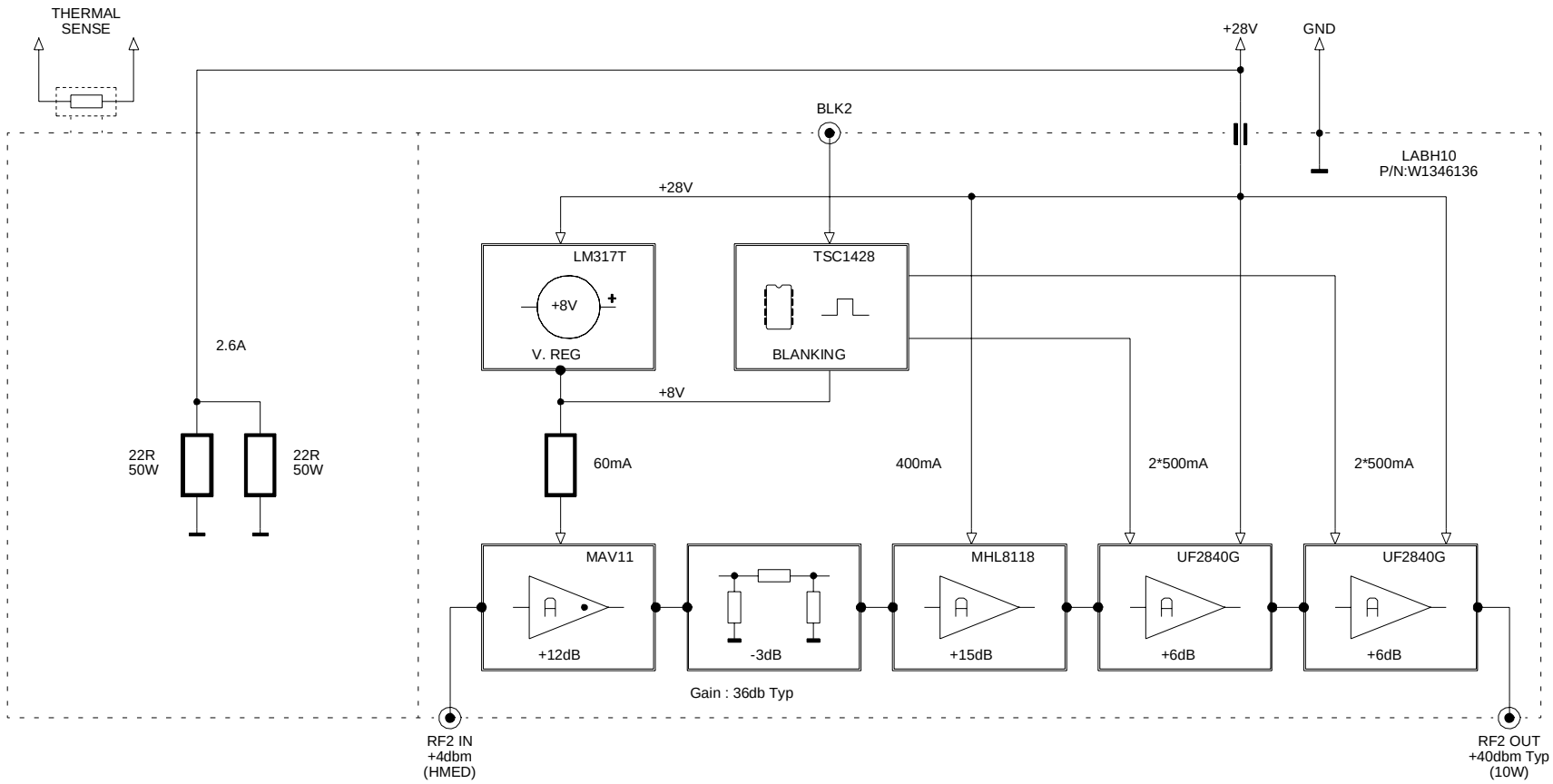


*Figure 5.9. BLA Rear Fan Assembly Interconnect Drawing*



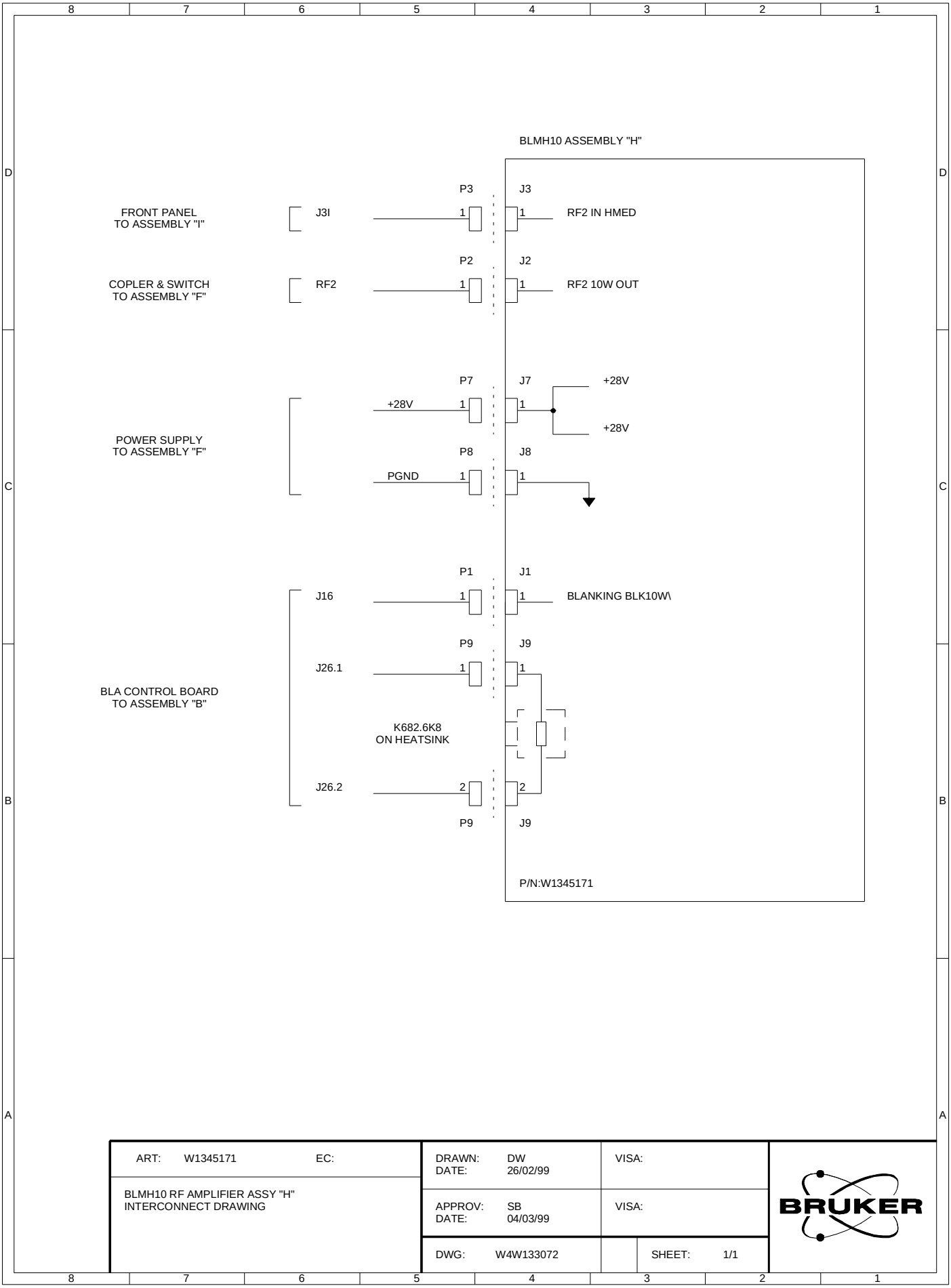

| | | | |
|---|---|---|---|
| ART: W1345181 EC: | DRAWN: DW<br>DATE: 02/03/99 | VISA: | BRUKER |
| BLA FAN ASSY "E"<br>INTERCONNECT DRAWING | APPROV: SB<br>DATE: 04/03/99 | VISA: | |
| | DWG: W4W133069 | - SHEET: 1/1 | |




| | | | |
|---|---|---|---|
| ART: W1345171 EC: 00 | DRAWN: DW DATE: 26/02/99 | VISA: | BRUKER |
| BLMH10 RF AMPLIFIER MODULE 700-1000MHZ RF BLOCK DIAGRAM | APPROV: SB DATE: 04/03/99 | VISA: | |
| | DWG: W4B133096 | A | SHEET: 1/1 |

*Figure 5.10. BLMH10 RF Amplifier Module 700-1000MHz*

*Figure 5.11. BLMH10 RF Amplifier Module 700-1000MHz Interconnect Drawing*




| | | | |
|---|---|---|---|
| ART: W1345171 EC: | DRAWN: DW<br>DATE: 26/02/99 | VISA: | |
| BLMH10 RF AMPLIFIER ASSY "H"<br>INTERCONNECT DRAWING | APPROV: SB<br>DATE: 04/03/99 | VISA: | |
| | DWG: W4W133072 | SHEET: 1/1 | |

*Figure 5.12. BLMH100 RF Amplifier Module 900MHz*

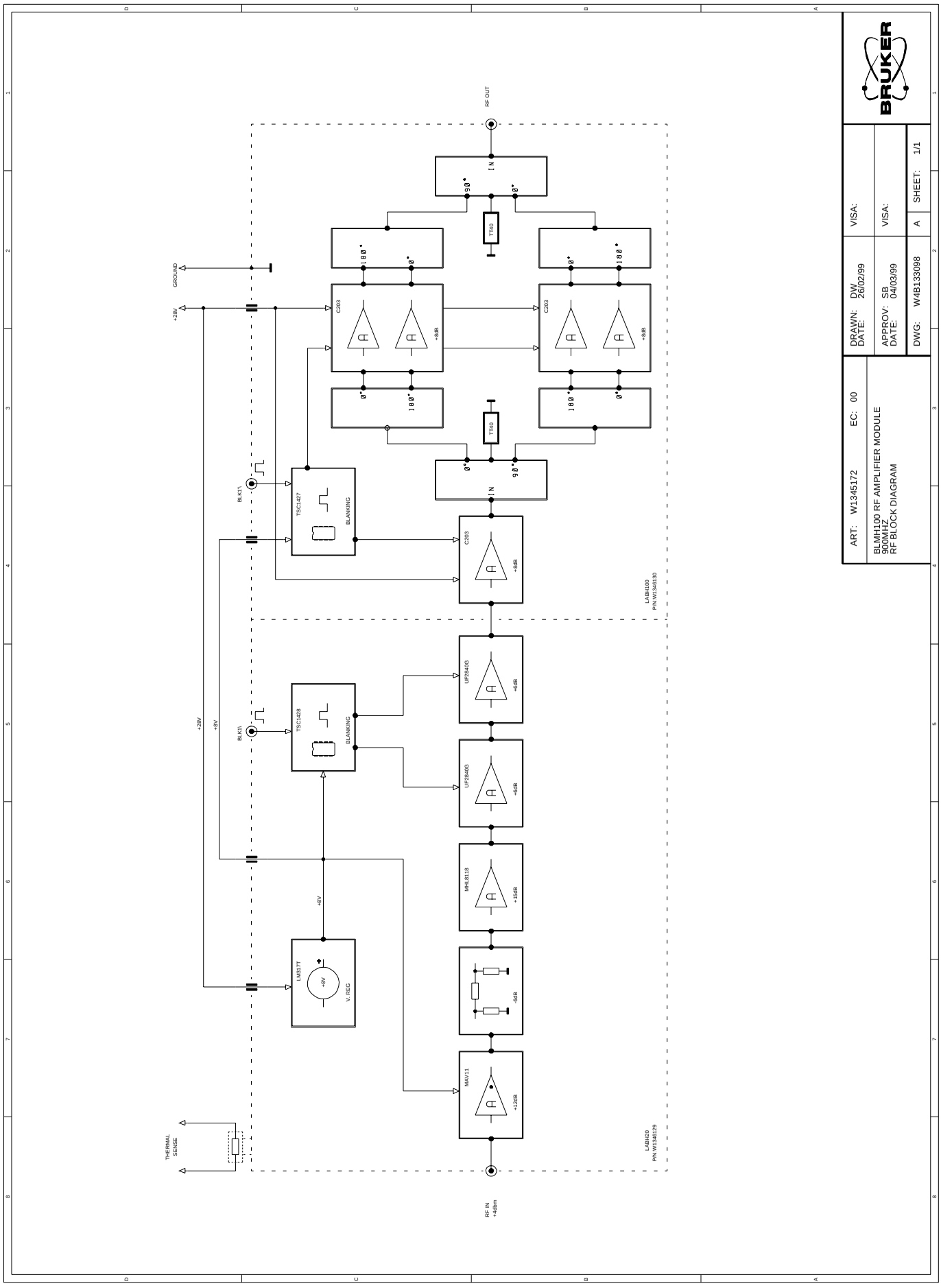


*Figure 5.13. BLMH100 RF Amplifier Module 900MHz Interconnect Drawing*

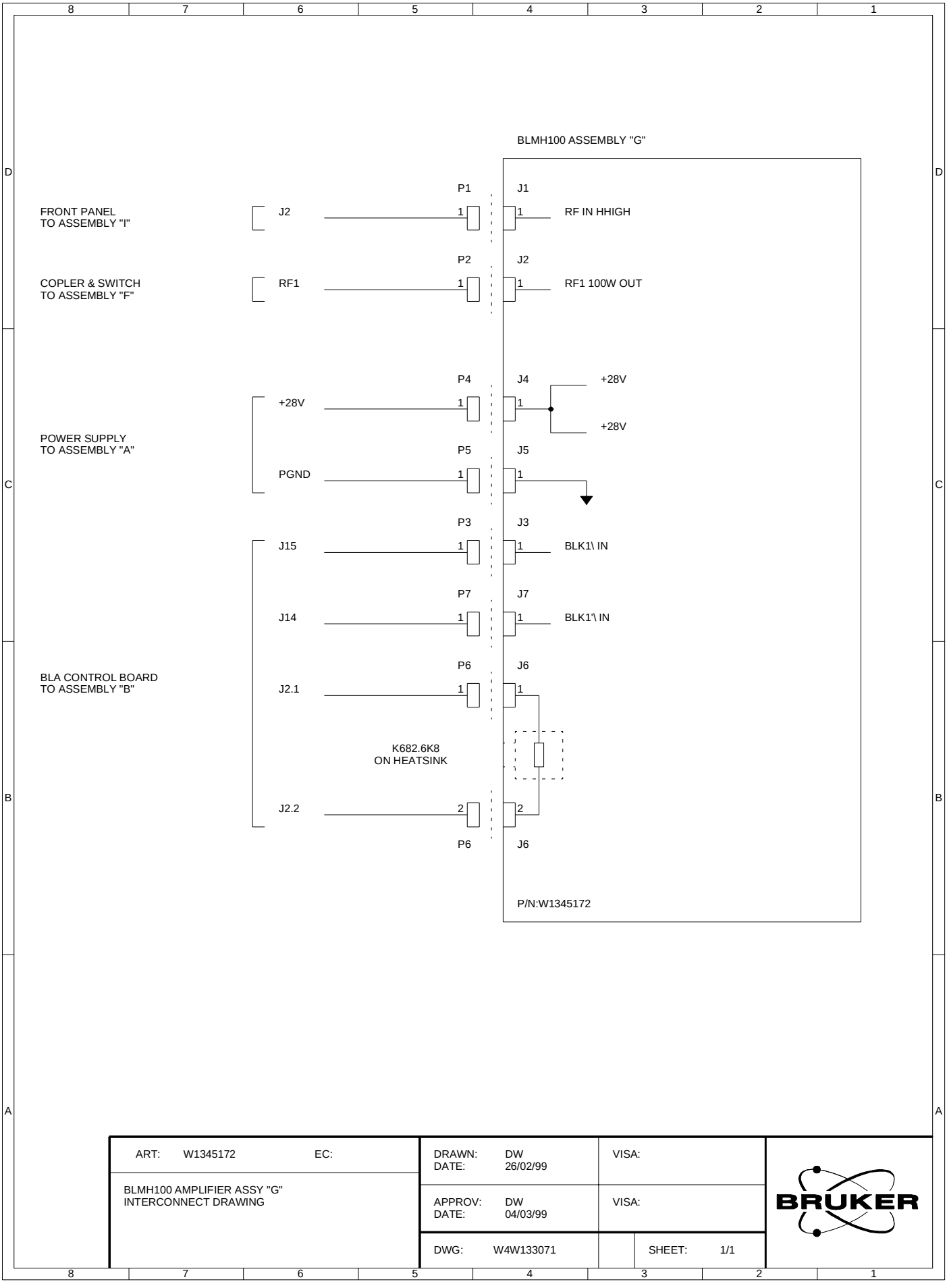
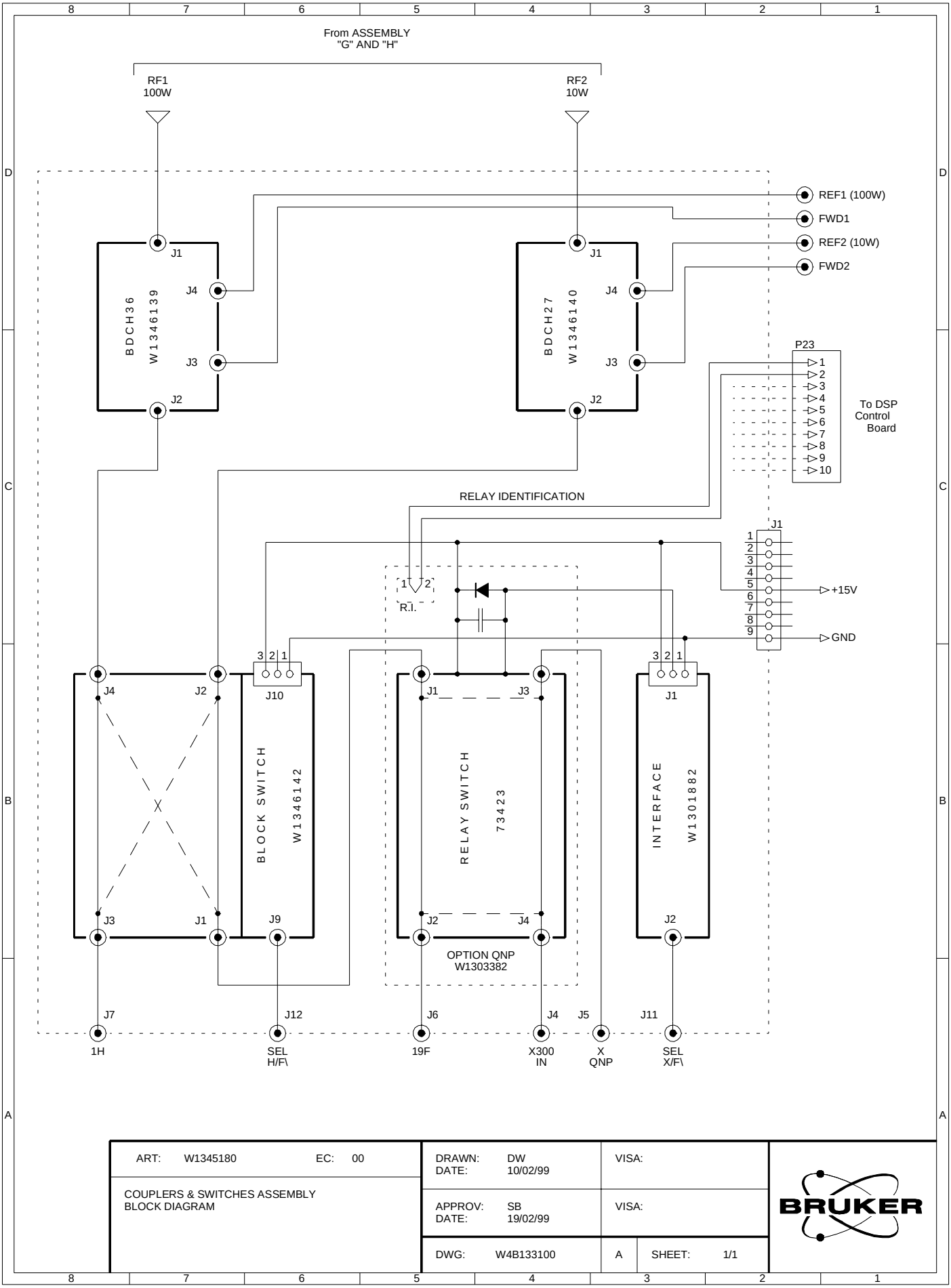


*Figure 5.14. Couplers & Switches Assembly*

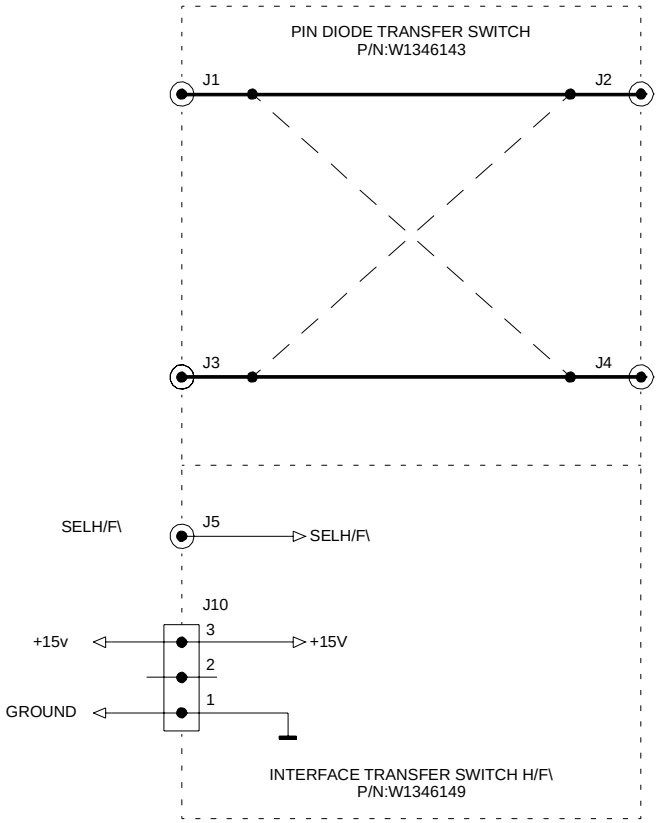



| | | | |
|---|---|---|---|
| ART: W1345180 EC: 00 | DRAWN: DW<br>DATE: 10/02/99 | VISA: | |
| COUPLERS & SWITCHES ASSEMBLY<br>BLOCK DIAGRAM | APPROV: SB<br>DATE: 19/02/99 | VISA: | |
| | DWG: W4B133100 | A | SHEET: 1/1 |

*Figure 5.15. Pin Diode Transfer Switch*

TRUTH TABLE

| SELH/F\ | RF CONTINUITY |
|---|---|
| 0 | J1 ◁⟷▷ J4 ; J3 ◁⟷▷ J2 |
| 1 | J1 ◁⟷▷ J2 ; J3 ◁⟷▷ J4 |

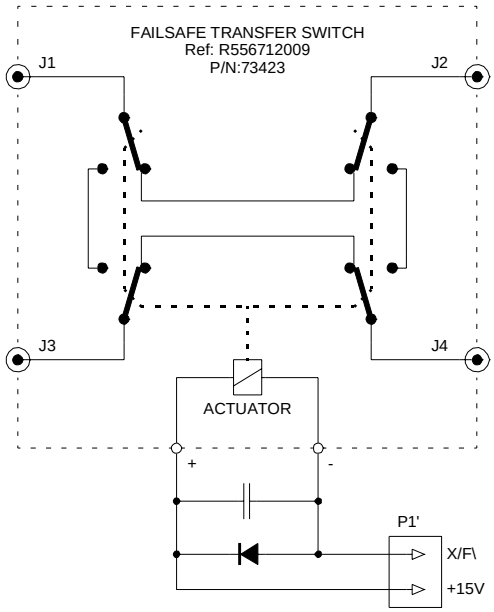



| | | | |
|---|---|---|---|
| ART: W1346142 EC: 00 | DRAWN: DW<br>DATE: 03/02/99 | VISA: | |
| PIN DIODE TRANSFER SWITCH<br>650-1000MHZ<br>BLOCK DIAGRAM | APPROV: SB<br>DATE: 19/02/99 | VISA: | |
| | DWG: W4B133099 | A | SHEET: 1/1 |

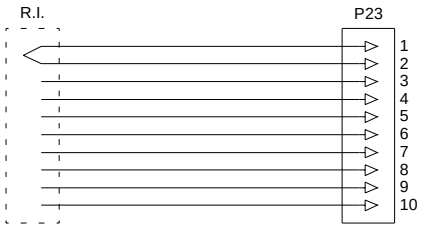
*Figure 5.16. Switch Relay for QNP Option*

TRUTH TABLE

| SELX/F\ | ACTUATOR | RF CONTINUITY |
|---|---|---|
| 0 | ENERGIZED | J1 ⟷ J3 ; J2 ⟷ J4 |
| 1 | DE-ENERGIZED | J1 ⟷ J2 ; J3 ⟷ J4 |

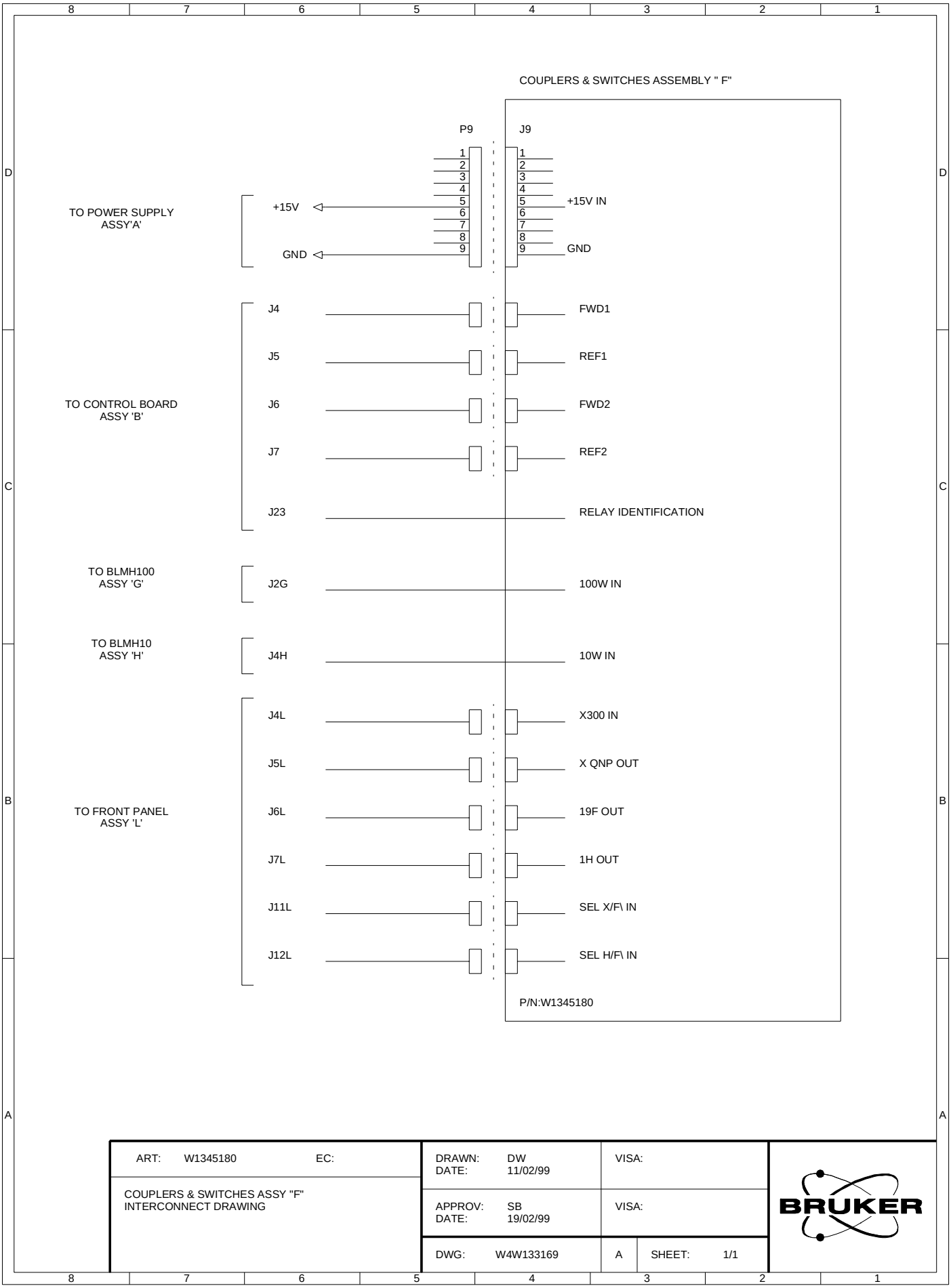



RELAY INDENTIFICATION




| | | | |
|---|---|---|---|
| ART: W1303382 EC: 00 | DRAWN: DW<br>DATE: 26/05/99 | VISA: | |
| SWITCH RELAY FOR QNP OPTION<br>FONCTIONS & TRUTH TABLE | APPROV: SB<br>DATE: 01/06/99 | VISA: | |
| | DWG: W4B133108 | A | SHEET: 1/1 |

*Figure 5.17. Couplers & Switches Interconnect Drawing*




| | | | |
|---|---|---|---|
| ART: W1345180 EC: | DRAWN: DW<br>DATE: 11/02/99 | VISA: | |
| COUPLERS & SWITCHES ASSY "F"<br>INTERCONNECT DRAWING | APPROV: SB<br>DATE: 19/02/99 | VISA: | |
| | DWG: W4W133169 | A | SHEET: 1/1 |

# Specifications 6

## Common Characteristics 6.1

| | |
|---|---|
| RF Input Connector | SMA (F) |
| RF Output Connector | N (F) |
| Blanking Pulse Connector | BNC (F) |

*Table 6.1. BLARH100 / 900 general specifications*

| RF SPECIFICATIONS | CHANNEL HHIGH | CHANNEL HMED |
|---|---|---|
| Frequency Range | 840 to 900 MHz | 650 to 1000 MHz |
| Linear Gain | 52 dB ± 1 typ. | 38 dB ± 1 typ. |
| Gain Flatness | ± 1.5dB max. | ± 1 dB max. |
| Minimum Pulsed Output Power (at nominal input + 4 dBm) | 100 W min. full range | 10 W min. full range |
| CW Output Power | 25 W max. (internal limitation) | no limitation |
| Linear Output Power | 50 W typ. at 1 dB compression | 5 W min. at 1 dB compression |
| Amplifier Biasing | Class AB Operation | Class AB Operation |
| Blanking Delay | < 1 µs typ. | < 1 µs typ. |
| RF Rise Time | < 100 ns | < 100 ns |
| RF Fall Time | < 50 ns | < 50 ns |
| DC Ringing | ± 200 mV typ. (due to blanking signal) | ± 200 mV typ. (due to blanking signal) |
| Input Noise Figure | 7 dB max. | 7 dB max. |
| Output Noise Power (Unblanked) | < - 115 dBm @ 1 Hz | < - 129 dBm @ 1 Hz |
| Output Noise Power (Blanked) | < - 174 dBm @ 1 Hz | < - 174 dBm @ 1 Hz |
| IN/OUT Impedance | 50 ohms | 50 ohms |
| Input V.S.W.R. | 1,5 max. | 1,5 max. |
| Output Harmonics | 30 dBc max. at 100 W | 30 dBc min full range |
| Pulse Width (int. limitation) | 500 ms @ 100 W (up to CW at 25 W) | no limitation |
| Duty Cycle (int. limitation) | 25 % @ 100 W (up to 100 % at 25 W) | no limitation |
| Amplitude Droop | < 8 % @ 100 W for 100 ms Pulse Width<br>< 5 % @ 50 W for 100 ms Pulse Width | < 5% @ 10 W for 500ms Pulse Width |

# Figures

# Figures

# Tables

# Tables