

ArbRider Series Digital Option

Add synchronized digital pattern outputs to the Model 670C, 675 and 685 arbitrary waveform generators: eight LVDS bits per rear-panel connector, and up to 32 bits on the 675-8C and 685-8C. This note covers the configurations, the LVDS and LVTTTL accessories, and the connector pinouts.

TECHNICAL NOTE · BNC ARBRIDER SERIES

1 What the digital option adds

The digital option adds parallel digital pattern outputs to the BNC ArbRider series arbitrary waveform generators, playing in lockstep with the analog channels. A single instrument then drives a device under test with its analog stimulus and the parallel digital control or data pattern that goes with it. The digital outputs are LVDS differential signals (100 Ω differential) on rear-panel mini-SAS HD connectors, and they share the instrument timebase, so each digital edge holds its position relative to the analog output. The number of outputs depends on the model and its analog channel count (Table 1).

Table 1. Digital output configurations, from each model's datasheet.

Table 1.

Model	Digital outputs (optional)	Output type	Maximum update rate per channel
670C (2 or 4 channels)	8 bits	LVDS	600 Mbps
675-2C / 675-4C / 675-8C	8 / 8 or 16 / 8, 16 or 32 bits	LVDS	1.2 Gbps
685-2C / 685-4C / 685-8C (and CD)	8 / 8 or 16 / 8, 16, 24 or 32 bits	LVDS	1.54 Gbps
686-4C-SE / 686-4CD	8, 16 or 32 bits (686-8DIG, 686-16DIG, 686-32DIG)	CML, programmable amplitude	10 Gbps

Each group of eight bits uses one rear-panel mini-SAS HD connector, so the 32-bit configurations use four. The Model 686 digital outputs are CML rather than LVDS, are offered on 4-channel models only, and are not covered by the LVDS pinout and accessory data in this note.

The digital outputs are enabled by a license key and connect through the **RIDER-MINI-SAS-HD** cable, a one meter cable that carries the eight LVDS pairs of one connector out of the instrument. The cable connector mates mechanically with standard mini-SAS HD hardware, but the electrical pinout is customized for the ArbRider series. Do not substitute a standard mini-SAS HD cable: it seats without trouble, but its electrical connections differ and the instrument will be damaged. Use only the RIDER-MINI-SAS-HD cable.



Schematic: the ArbRider rear-panel mini-SAS HD connector feeds the RIDER-MINI-SAS-HD cable to the AT-LVDS-SMA8 (eight LVDS pairs on 16 SMA) or the AT-DTLL8 (eight LVTTTL outputs).



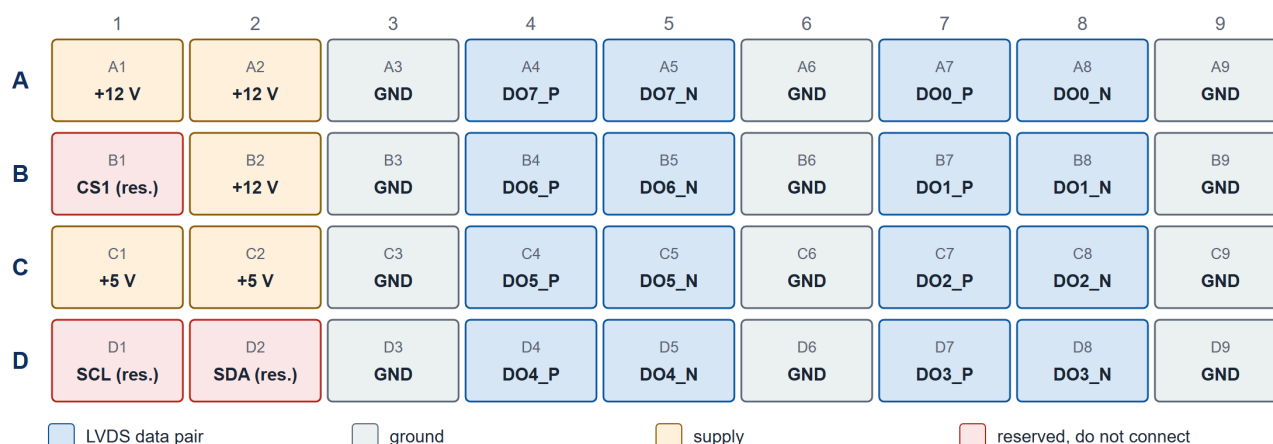
Two accessories convert the LVDS bus into the signal standard the bench needs, and each is ordered separately. The **AT-LVDS-SMA8** is a mini-SAS to SMA adapter that breaks the eight LVDS outputs out to 16 SMA connectors, two SMA per LVDS pair. The **AT-DTLL8** is a probe that connects to the RIDER-MINI-SAS-HD cable and converts the LVDS outputs to single-ended LVTTTL signals.

Connecting to a custom board

To connect the RIDER-MINI-SAS-HD cable to a custom board rather than to one of the BNC accessories, use a standard mini-SAS HD receptacle such as the Amphenol 10112626-101LF, Amphenol 10112632-101LF, Amphenol 10120666-101LF, or TE Connectivity 2198484-1. The mechanical mating is standard, but the board must be wired to the custom electrical pinout of Figure 1 and the table below, not to the usual mini-SAS HD assignment. The pin map covers both the raw signal on each mini-SAS HD pin and the corresponding SMA on the AT-LVDS-SMA8 adapter.

Mini-SAS HD digital connector: signal by pin (ArbRider LVDS models)

Schematic



SCHEMATIC Figure 1. Signal assigned to each mini-SAS HD pin, rows A to D and pins 1 to 9, for the ArbRider LVDS models.

Mini-SAS HD connector pinout

The table lists each mini-SAS HD pin, the signal assigned to it, and the matching position on the AT-LVDS-SMA8 16-SMA breakout. Pins marked reserved must not be connected.

Table 2.

Mini-SAS HD pin	Assigned signal	AT-LVDS-SMA8 (16 SMA)
A1	+12 Vcc	NA
A2	+12 Vcc	NA
A3	GND	SMA Ground
A4	DO7_P	DO 7_P
A5	DO7_N	DO 7_N
A6	GND	NA
A7	DO0_P	DO 0_P
A8	DO0_N	DO 0_N
A9	GND	SMA Ground

Mini-SAS HD pin	Assigned signal	AT-LVDS-SMA8 (16 SMA)
B1	CS1 (reserved, do not connect)	NA
B2	+12 Vcc	NA
B3	GND	SMA Ground
B4	DO6_P	DO 6_P
B5	DO6_N	DO 6_N
B6	GND	SMA Ground
B7	DO1_P	DO 1_P
B8	DO1_N	DO 1_N
B9	GND	SMA Ground
C1	+5 Vcc	NA
C2	+5 Vcc	NA
C3	GND	SMA Ground
C4	DO5_P	DO 5_P
C5	DO5_N	DO 5_N
C6	GND	SMA Ground
C7	DO2_P	DO 2_P
C8	DO2_N	DO 2_N
C9	GND	SMA Ground
D1	SCL (reserved, do not connect)	NA
D2	SDA (reserved, do not connect)	NA
D3	GND	SMA Ground
D4	DO4_P	DO 4_P
D5	DO4_N	DO 4_N
D6	GND	SMA Ground
D7	DO3_P	DO 3_P
D8	DO3_N	DO 3_N
D9	GND	SMA Ground

Caution

The RIDER-MINI-SAS-HD cable uses a customized electrical pinout. Although it mates mechanically with standard mini-SAS HD connectors, a standard cable will damage the instrument. Use only the RIDER-MINI-SAS-HD cable, and never connect the reserved CS1, SCL, or SDA pins.

AT-LVDS-SMA8: LVDS to 16 SMA breakout

The **AT-LVDS-SMA8** cable adapter converts the mini-SAS HD connector on the instrument rear panel to 16 SMA connectors. It preserves the signal integrity and gives the flexibility needed to route the high speed digital signals from the BNC ArbRider AWG series to individual coaxial inputs. Each of the eight LVDS pairs lands on two SMA connectors, one for the positive and one for the negative leg, so the full eight-bit bus is available as differential pairs across 16 SMA. The proprietary cable is one meter long.

Table 3.

Parameter	Specification
Output connector	SMA
Output type	LVDS
Number of SMA	16 (8 bits)
Cable type	Proprietary standard
Cable length	1 meter (39.4 in)

AT-DTLL8: LVDS to LVTTTL probe

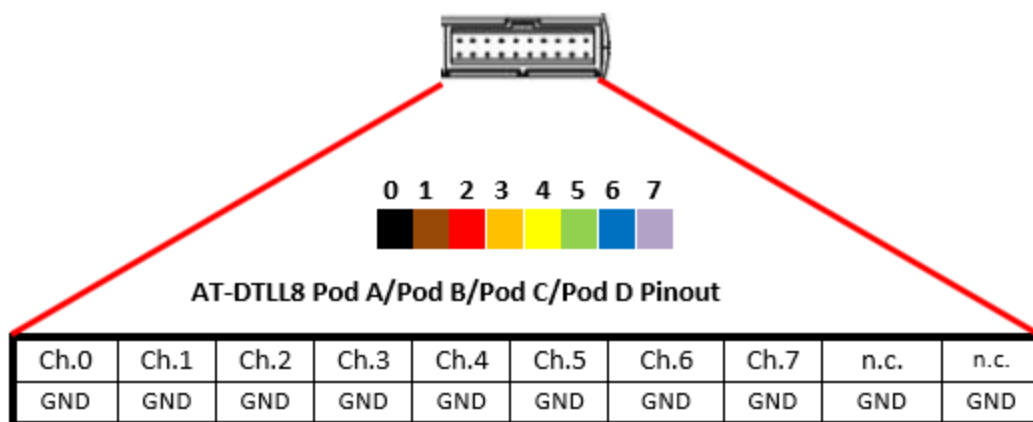
The **AT-DTLL8** is an eight-bit LVDS-to-LVTTTL adapter that converts the LVDS differential signals from one mini-SAS HD digital connector to single-ended LVTTTL outputs (Figure 2). The output high level is programmed from software between 0.8 V and 3.8 V, for the group of eight bits. The maximum update rate depends on the programmed level: 125 Mbps at 0.8 V and 400 Mbps at 3.6 V.



■ **PHOTO** **Figure 2.** The AT-DTLL8 probe on its one meter mini-SAS HD cable, with the single-ended output leads.

Ordering note

The RIDER-MINI-SAS-HD cable, the AT-DTLL8 probe and the AT-LVDS-SMA8 adapter are separate ordering items from the digital license. Order the cable with the license, and the probe or the adapter for the signal standard required.



■ **SCHEMATIC** **Figure 3.** AT-DTLL8 pod pinout. The 20-position header carries channels 0 through 7, each with a ground, and two positions that are not connected; the same pinout applies to pods A, B, C and D.

AT-DTLL8 output connector

The LVTTTL signals are presented on a 20-position, 2.54 mm (0.1 in), two-row IDC header (Figure 3). Channels 0 through 7 occupy eight positions, each paired with a ground, and the two remaining positions are not connected.

Table 4.

Parameter	Specification
Output connector	20-position, 2.54 mm (0.1 in), 2-row IDC header
Output electrical standard	LVTTTL
Output impedance	50 Ω nominal
Output voltage	0.8 V to 3.8 V, programmable in a group of 8 bits
Maximum update rate	125 Mbps at 0.8 V, 400 Mbps at 3.6 V
Dimensions	2.05 in W $\times$ 0.87 in H $\times$ 2.99 in D (52 mm $\times$ 22 mm $\times$ 76 mm)
Input connector	Proprietary standard
Cable length	1 meter (39.4 in)
Cable type	Proprietary

Choosing the right output path

The choice follows the signal standard the device under test expects. For coaxial inputs and native differential signaling at the full LVDS rate (1.54 Gbps per channel on the 685), take the LVDS bus out on the AT-LVDS-SMA8 and land each pair on its own SMA. For single-ended logic inputs, the AT-DTLL8 gives software-programmable LVTTTL levels from 0.8 V to 3.8 V on a standard 0.1 in header, at up to 125 Mbps at 0.8 V and 400 Mbps at 3.6 V. In either case the digital bits stay synchronized to the analog channels through the shared instrument timebase.

Talk to an application engineer

Berkeley Nucleonics can help you specify the digital option, the RIDER-MINI-SAS-HD cable, and the AT-LVDS-SMA8 or AT-DTLL8 accessory for your ArbRider 670C, 675, or 685 configuration. Call **800-234-7858** or email info@berkeleynucleonics.com.

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Technical Note

BNC ArbRider Series