JRC Radar Interfacing

Connecting to JRC sub display analogue radar video output and appropriate software configuration

Summary

A number of popular JRC radar models provide a common analogue radar video interface, specifically designed for use with external equipment. This interface, known variously as the "sub display", "slave display" or "remote display" interface, provides analogue video, trigger, ACP and ARP signals and is fully compatible with Cambridge Pixel's HPx radar interface cards.

Successful interfacing to a JRC radar requires the correct physical connections to be made and also a number of corresponding software settings. This application note describes the physical connection to the radar, the appropriate jumper settings on HPx cards and the appropriate software settings.

Introduction

Many popular older JRC radars, such as the JMA-5300MK2, provide an analogue interface from which external equipment may receive polar radar video and corresponding control signals. Typically, there may be one or two of these "sub display" interfaces, each providing video, trigger, azimuth and azimuth reset signals.

Depending on the model of JRC radar, these sub display interfaces can generally be found on the processor or the display board, within the radar transceiver unit, as a 10-pin header directly from the PCB.

The video signal itself is inverted, lying between 0V (no signal) and -2V (full signal), with an input impedance of 50 Ohms.

The trigger pulse is single-ended, with a nominal amplitude of 4V into a high impedance (180 Ohm) load. The azimuth and azimuth reset pulses are open-collector, requiring a 1 kOhm pull-up to 5V. There are 2048 azimuth pulses per scan.

The sub display interface for a given JRC radar will often be mentioned in the installation manual for that radar, rather than the user manual. In particular, the "interconnection diagrams" given at the rear of these manuals often show the connector location and pinout. The Azimuth Change Pulse (ACP) will usually be referred to as a "bearing pulse" or simply "BP"/"BPO". Similarly, the Azimuth Reset Pulse (ARP) will likely be called "bearing zero" or simply "BZ"/"BZO".

Physical Interfacing

When connecting to the radar for the first time **it is important to look at the signals on an oscilloscope first**, to confirm that they are on the expected pins and have the anticipated amplitude [noting that the bearing (ACP) and bearing zero (ARP) signals are open-collector and therefore require "pulling up" first].

A 10-pin sub display output will usually have the pinout given in the table below.

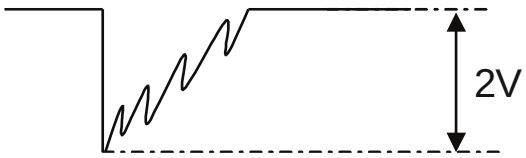
Pin	Signal	Description
3	TRGOE	Trigger pulse return
4	TRGO	Trigger pulse
5	BPOE	Bearing pulse (ACP) return
6	BPO	Bearing pulse (ACP)
7	BZOE	Bearing zero pulse (ARP) return
8	BZO	Bearing zero pulse (ARP)
9	VDOE	Analogue video return
10	VDO	Analogue video

The expected signals are described below.

Video

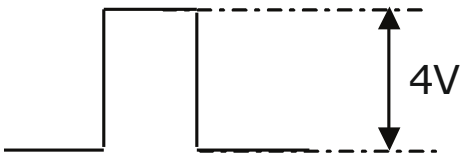
The video signal is a negative signal and the wave form is as shown on the right, with black level at 0V and peak amplitude at -2V.

Characteristic impedance is 50 Ohms.



Trigger

The trigger signal is single-ended, with approximately 4 volt amplitude and 180 Ohms termination.



ACP / Bearing Pulse (BP)

The bearing pulse output is open-collector, providing 2048 pulses per antenna rotation.

This signal should be pulled up to 5V at 1kOhm before use.

ARP / Heading Pulse (HD) / Bearing Zero (BZ)

The heading pulse output is open-collector, proving 1 pulse per antenna rotation.

This signal should be pulled up to 5V at 1kOhm before use.

Cabling

Depending on the model of JRC radar and potential fitted options, the sub display interface will usually be located on the terminal board, within the display unit.

Single-ended and open-collector signals should be carried on coax, with the core used to carry the signal and the shield used for the corresponding return.

The mapping of JRC sub display signals to HPx inputs is given below, please refer to the relevant HPx user manual for the actual connector pinout.

JRC Signal	Description	HPx Input
BZOE	Return for azimuth reset	ARPL
BZO	Azimuth reset pulse (i.e. heading or ARP)	ARPH
BPOE	Return for bearing pulse	ACPL
BPO	Bearing pulse (i.e. ACP)	ACPH
TRGOE	Return for trigger	TRGL
TRGO	Trigger pulse signal	TRGH
VDOE	Return for video signal	AGND
VDO	Analogue video signal	VIDA

HPx Jumper Settings

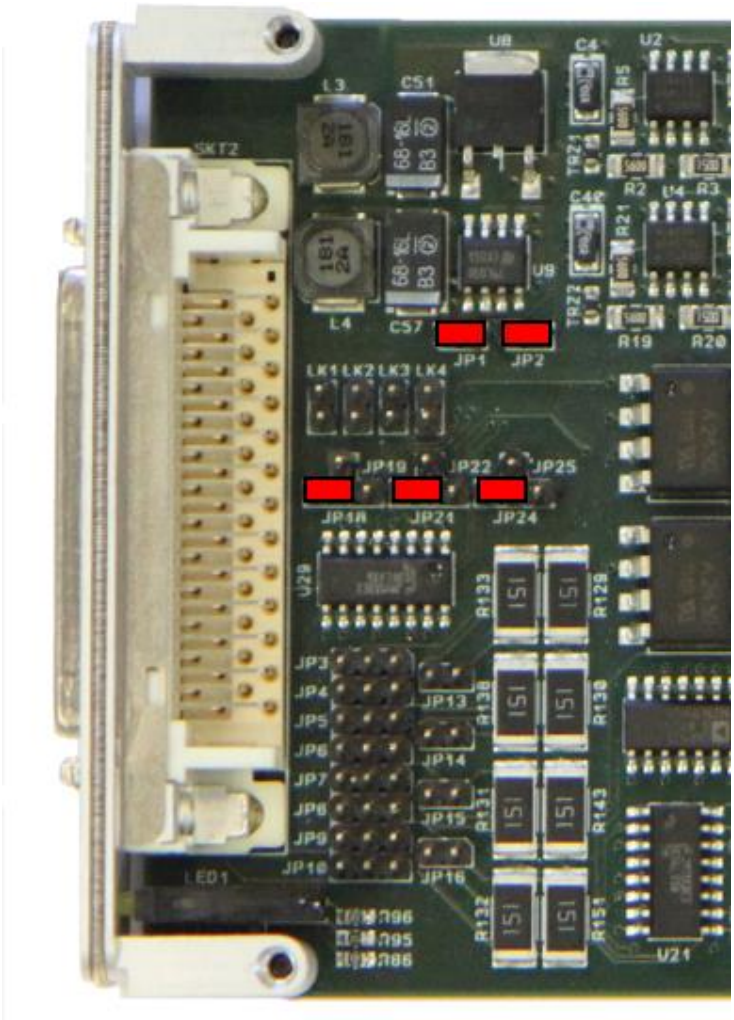
Assuming that the measured outputs from the radar match those described above, the HPx radar interface hardware should be configured for:

- Video: 50 Ohm impedance where the hardware supports it, 75 Ohm otherwise.
- Trigger: single-ended, "low" voltage range, high impedance.
- ACP: open-collector, where the hardware supports it directly (e.g. HPx-346, HPx-410), or single-ended "low" voltage range, high impedance, where an external pull-up is required (e.g. HPx-250)
- ARP: as ACP

The following sections summarise the link settings for each available HPx radar interface card.

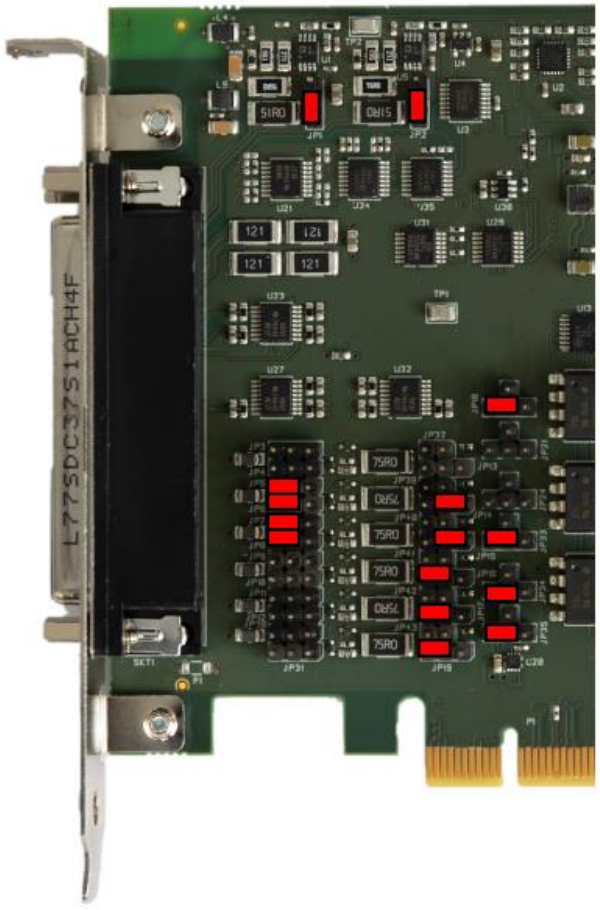
HPx-250

Signal	Link Configuration	Description
Video	Fit: 1 and 2	Analogue radar video input channel A set for 75 Ohm impedance input.
Trigger	Remove: 3, 4, 13 Fit: 18 (left)	Single-ended, "low" range input through opto-coupler. High impedance.
ACP (BP)	Remove: 5, 6, 14 Fit: 21 (left)	Single-ended, "low" range input through opto-coupler. High impedance. **Note**: external pull-up required.
ARP (HD)	Remove: 7, 8, 15 Fit: 24 (left)	ARP pulse set for single-ended, "low" range input through opto-coupler. High impedance. **Note**: external pull-up required.



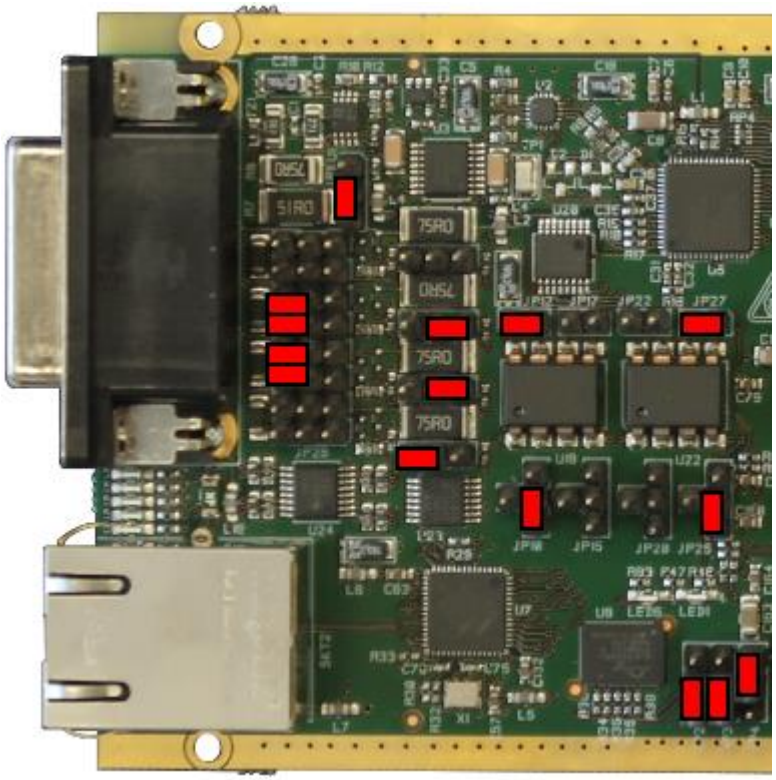
HPx-410

Signal	Link Configuration	Description
Video	Fit: 1 and 2 (bottom)	Analogue radar video input channel A and B set for 50 Ohm impedance input.
Trigger	Remove: 3, 4, 13, 32 Fit: 18 (left)	Single-ended, "low" range input through opto-coupler. High impedance.
ACP (BP)	Remove: 21 Fit: 5, 6 (left), 14 (right)	Open collector.
ARP (HD)	Remove: 24 Fit: 7, 8 (left) 15 (right)	Open collector



HPx-346

Signal	Link Configuration	Description
Video	Fit: 1 (bottom)	Analogue radar video input channel A set for 50 Ohm impedance input.
Trigger	Remove: 8, 9, 11 Fit: 10 (bottom), 12	Single-ended, "low" range input through opto-coupler. High Z impedance.
ACP (BP)	Remove: 15, 17 Fit: 13 (left), 14 (right), 16 (left)	Open collector.
ARP (HD)	Remove: 20, 22 Fit: 18 (left), 21 (left), 19 (right)	Open collector.

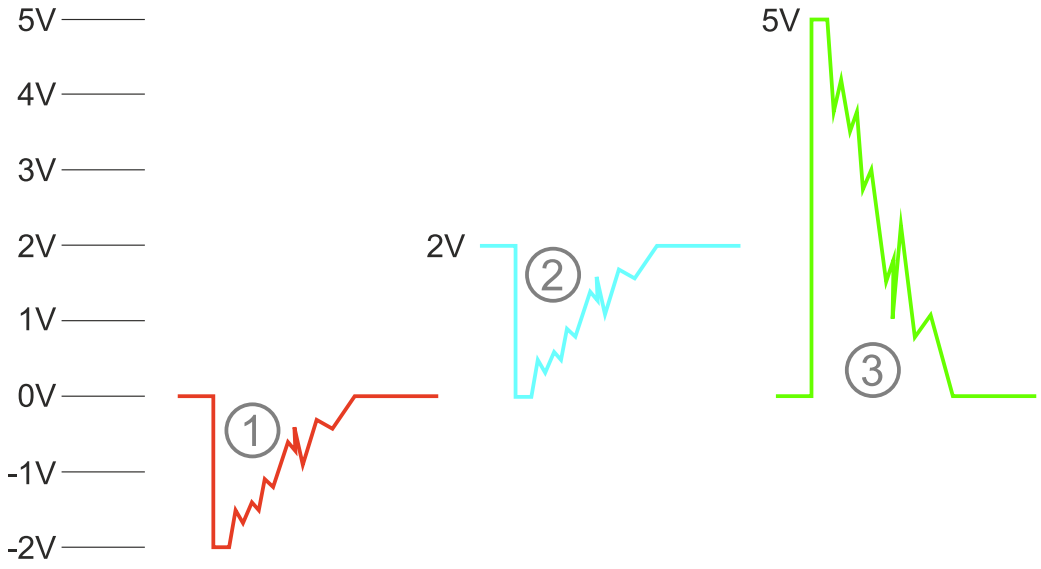


Corresponding Software Settings

Setting the links on the HPx card correctly allows the signals to be received by the card. A number of accompanying software settings are also required, in order to get the video correctly processed by the card. In the case of the HPx-346 card these settings are made through the firmware (e.g. via the web interface). For PCIe or PMC cards the controlling software may be a ready-made Cambridge Pixel application, such as SPx Server, or a custom developed application that uses the SPxHPx100Source class.

Trigger input on the card should be set to the single-ended (opto-coupler) option. Where supported, the ACP and ARP inputs should be set to "open collector". The HPx-250 card, which does not support open collector inputs directly, the ACP and ARP signals must be pulled-up to 5V and the corresponding inputs set to the single-ended (opto-coupler) option. Furthermore, the ACP and ARP inputs should have their "inverted" option set in this case.

Since the radar video signal is negative, between 0V and -2V, it is necessary to invert it on the HPx card. This is simply a matter of setting appropriate offset and gain values, as depicted below.

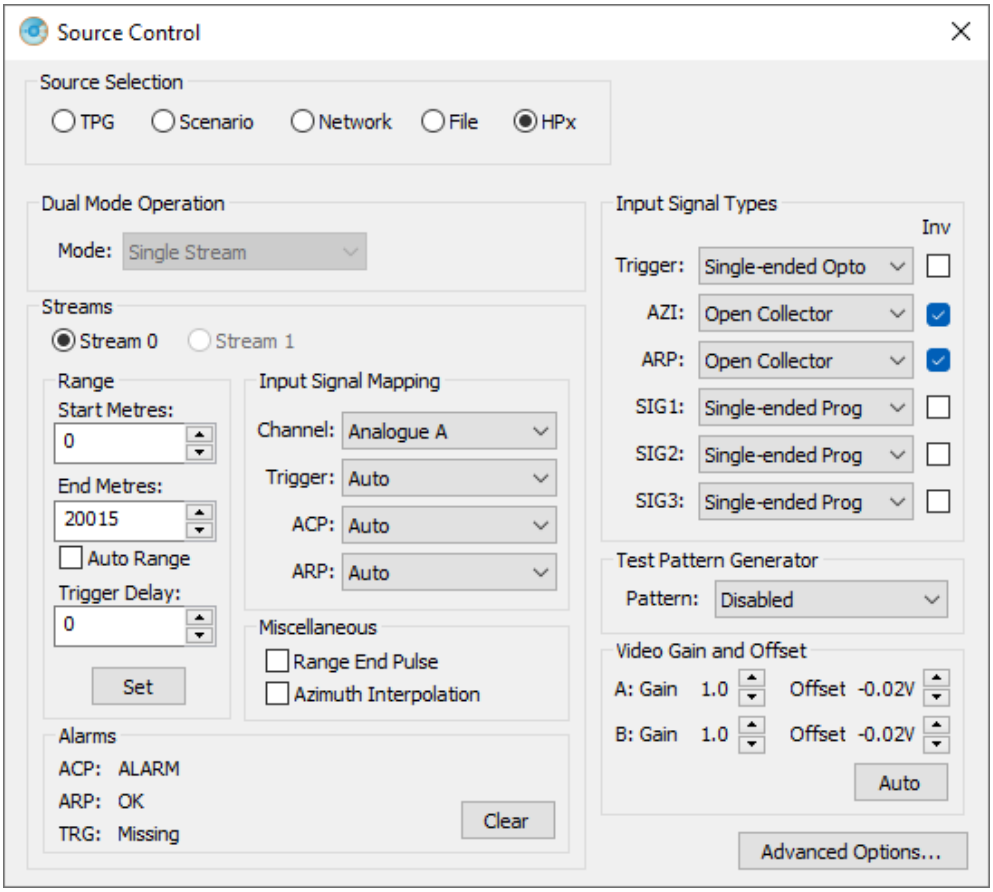


1. The video signal coming from the radar ranges from 0V (no signal / black level) to -2V peak.

2. Applying an offset of +2V on the HPx card shifts the whole signal up into the range 0V to +2V. At this stage, the video is still inverted, 2V is black and 0V is peak signal.

3. Applying a gain of -2.5 has the effect of scaling the video to fill the 0 to +5V digitisation range and inverting it so that 0V is black and +5V is peak.

As an example, the following image shows the configuration discussed above set in the HPx source control dialog in SPx Server.



< End of document >