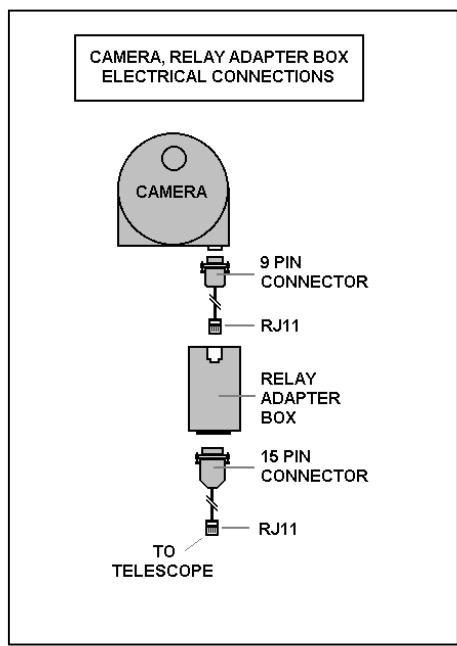




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Application Note
Relay Adapter Box
January 2007

This is an update to the Application Notes provided with the Relay Box as a set of instructions. The Relay Box has been used in the same configuration for a number of years and some of the references in the instructions are dated, although the details and specifications have not changed. For instance, wherever the instructions refer to the ST-7/8 cameras, they now also apply to any ST or STL camera that has a 9 pin "AO/SCOPE/CFW" port. Also, we now provide 3 cables with the Relay Box. The basic configuration is shown below:



1. The Relay Box Power Cable is the 9 pin to RJ11 cable that goes between the camera and the Relay Box, and
2. The Relay Box Output Cable (formerly called the TIC cable) is the 15 pin to RJ11 cable that goes between the Relay Box and your telescope drive's autoguider input (sometimes called "CCD: port on LX200").
3. The Dual Relay Cable is a short ribbon cable that is used if you have more than one accessory plugged into the "AO/SCOPE/CFW" port on the camera.

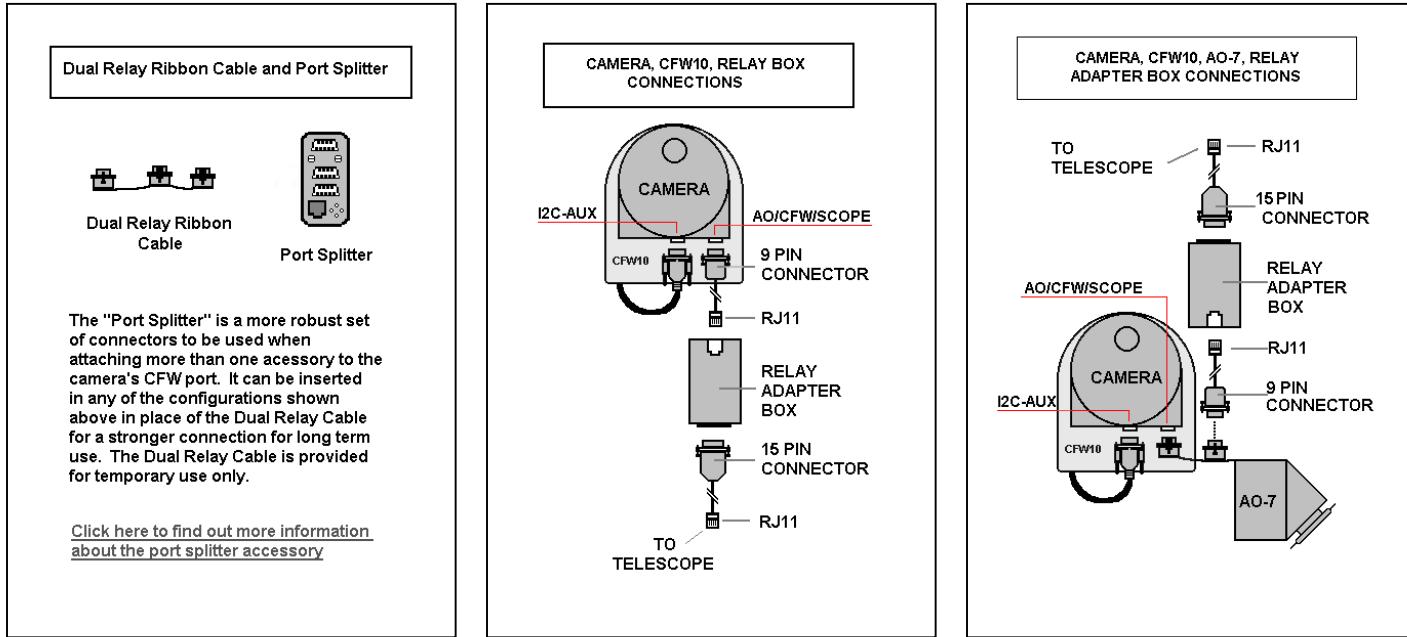
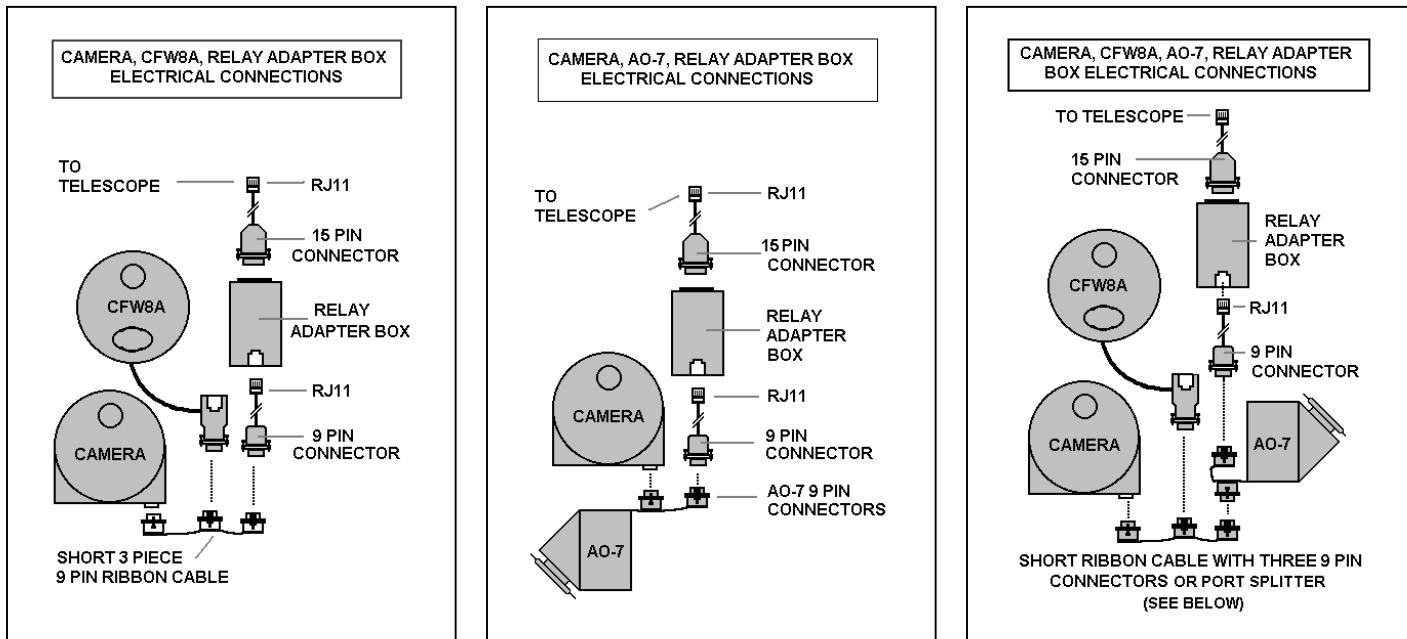
The Dual Relay Cable is provided only so that the Relay Box can be used immediately in a variety of configurations. If your system requires more than one connection be made to the "AO/SCOPE/CFW" port on the bottom of the camera, we recommend that you replace the Dual Relay Cable with the more robust Port Splitter for permanent use.

There are a variety of possible combinations of camera, filter wheels, AO and relay box. Some common configurations are shown in the diagrams on the next page.

We recommend the relay box be used with all Losmandy mounts, even the newer mounts with the Gemini GOTO electronics.

For more combinations please see the Application Notes Section of our web site. Specifically:

<http://www.sbig.com/sbwhtmls/connections.htm>



The CFW9 uses the I2C port on USB cameras the same as the CFW10 shown above.

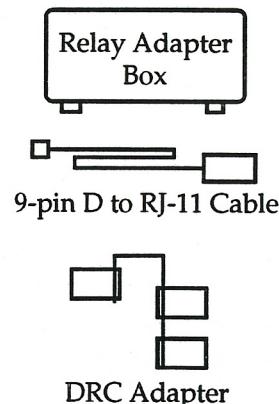
Application Note

Relay Adapter Box

This Application Note describes the Relay Adapter box, an accessory for use with the ST-7/8 and PixCel 255 CCD cameras.

The Relay Adapter Box Package the following items:

1. The Relay Adapter Box
2. A "9-pin D to RJ-11" Cable for connecting the Relay Adapter Box to an ST-7
3. A "Dual Relay Cable Adapter" (DRC) for splitting the ST-7/8 Telescope Port into two
4. These Instructions



One of the functions common in the SBIG cameras and software is autoguiding where the CCD camera measures a guide star's position on the CCD array and corrects the telescope's position to guide long duration astrophotographs. In order for the camera to correct the telescope's position the camera needs to be interfaced to the telescope.

In the original ST-4 autoguider the ST-4 interfaced to the telescope through four electromechanical relays contained within the ST-4. Each relay had a Common, Normally Open and Normally Closed contact. The advantages of this type of interface are that the relays are completely isolated from the camera and could be used in a wide variety of telescope drive correctors. When the ST-4 wanted to make a correction it activated the relay and that could be wired into the hand controller to simulate the user pressing one of the four guiding buttons.

As telescope systems evolved, CCD input jacks started showing up on telescopes (like the Meade LX-200). These CCD inputs came about in the "digital age". Rather than having to interface to the hand controller, when you wanted to correct the telescope's position you simply grounded one of four inputs on a 6 pin RJ-11 phone jack.

The ST-7/8 and PixCel 255 were designed with this interface in mind. Rather than using the electromechanical relays, solid state relays were used. This allowed for very accurate control of the telescope and increased reliability due to the nature of solid state relays.

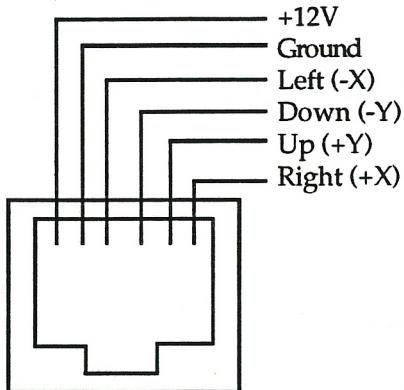
But these cameras can be used with older telescopes that do require the electromechanical interface, either because they depend on electrical isolation between the camera and the telescope or, rather than pulling a digital signal to ground, they require adding or removing some resistance from the drive corrector circuitry to speed up or slow down the motors for example.

To make a long story short, the Relay Adapter Box gives the ST-7/8 and PixCel 255 the electromechanical interface found in the ST-4.

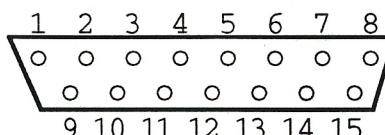
How it Works

A schematic of the Relay Adapter Box is attached to the end of this note. Essentially the Relay Adapter Box consists of four electromechanical relays that are activated by the solid state relays in the ST-7/8 or PixCel 255 cameras.

The input to the Relay Adapter Box is through a 6 pin RJ-11 phone jack connector. This connector brings in the solid state relay outputs (4 signals), 12 Volt power and Ground. The pinouts of this connector are shown in the figure below:



The output of the Relay Adapter Box is through a 15 Pin Male D connector. The pinouts of this connector are shown in the figure below and are the same as the ST-4, ST-4X, ST-5 and ST-6 camera's Relay port. *If you have already modified your telescope for one of these cameras you can interface it to the Relay Adapter Box by simply connecting the Relay Adapter Box in place of the ST-4, etc.*



Pin	Function	Pin	Function
1	No connect	9	No connect
2	No connect	10	+X Normally Open
3	+X Normally Closed	11	+X Common
4	-X Normally Open	12	-X Normally Closed
5	-X Common	13	+Y Normally Open
6	+Y Normally Closed	14	+Y Common
7	-Y Normally Open	15	-Y Normally Closed
8	-Y Common		

Using the Relay Adapter Box with an ST-7/8

The Relay Adapter Box comes with a "9-Pin D to RJ-11" cable that is used to connect the Relay Adapter Box to the ST-7/8. While you would think you could just use the standard 6 pin RJ-11 based tracking cable that came with the ST-7 to connect to the Relay Adapter Box that will not work. The reason being that the standard tracking cable does not bring through the +12V signal that powers the electromechanical relays whereas the 9-pin D to RJ-11 does.

Caution: Never connect the "9-pin D to RJ-11" cable provided with the Relay Adapter Box directly to the telescope driver corrector because the 12V power in this cable can damage your telescope. Always use the small black adapter and telephone cable provided with the ST-7/8 for direct connections.

If you plan on using the Relay Adapter Box in conjunction with a CFW-8 Color Filter Wheel then you need to use the "Dual Relay Cable Adapter" at the ST-7/8 to split the camera's 9 pin telescope port into 2, plugging the CFW-8 into one port and the Relay Adapter Box into the other.

Using the Relay Adapter Box with a PixCel 255

You must set a jumper inside the PixCel 255 CPU to use the Relay Adapter Box. This jumper, labeled JP-1 must be connected to bring the +12 power out the Telescope Port (it is left unconnected at the factory). With this jumper in place you simply plug the Relay Adapter Box into the PixCel 255's Telescope port using the Tracking Cable that was supplied with the PixCel 255. You do not need the "9-pin D to RJ-11" or "DRC" cables.

Caution: JP-1 allows 12V power out the telescope port to drive the Relay Adapter Box. If you ever go back to connecting the PixCel 255 directly to the Telescope
YOU MUST remove jumper JP-1 or else the 12V could damage the telescope.

When do I need to use a Relay Adapter Box with an ST-7/8 or PixCel 255?

The answer to this question is not always clear and concise. Here are the situations we know:

You do not need the Relay Adapter Box if:

1. You are using the camera with LX-200 telescopes.
2. Your telescope/drive corrector uses "Open Collector to Ground" inputs for guiding. Check with your drive manufacturer to be sure.
3. You are using a Celestron Ultima or Losmandy mount and are running both the camera and telescope off the 110V AC wall transformers where the camera and drive corrector do not share a common ground.

You do need the Relay Adapter Box if:

1. You are using a Celestron Ultima or Losmandy mount and running the telescope and/or camera off 12V power.
2. You are using a Celestron Ultima or Losmandy mount with some 3rd piece of equipment (like digital setting circles) that causes the camera and drive corrector to share a common ground.
3. Your telescope/drive corrector is an older design where you can not simply "connect to ground" the four inputs to guide the telescope.

Other Accessories

SBIG also has the following accessories available for use with the Relay Tracking Box:

Standard Relay Cable - This cable has a 15 pin D connector on one end (to plug into the Relay Adapter Box) and 15 flying leads on the other end for custom installation into drive correctors or hand controllers.

TIC Cable - This cable has a 15 pin D connector on one end (to plug into the Relay Adapter Box) and a RJ-11 connector on the other end for use with Celestron Ultima and Losmandy Mounts.

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**ST-7/ST-8 Relay Adapter Box**

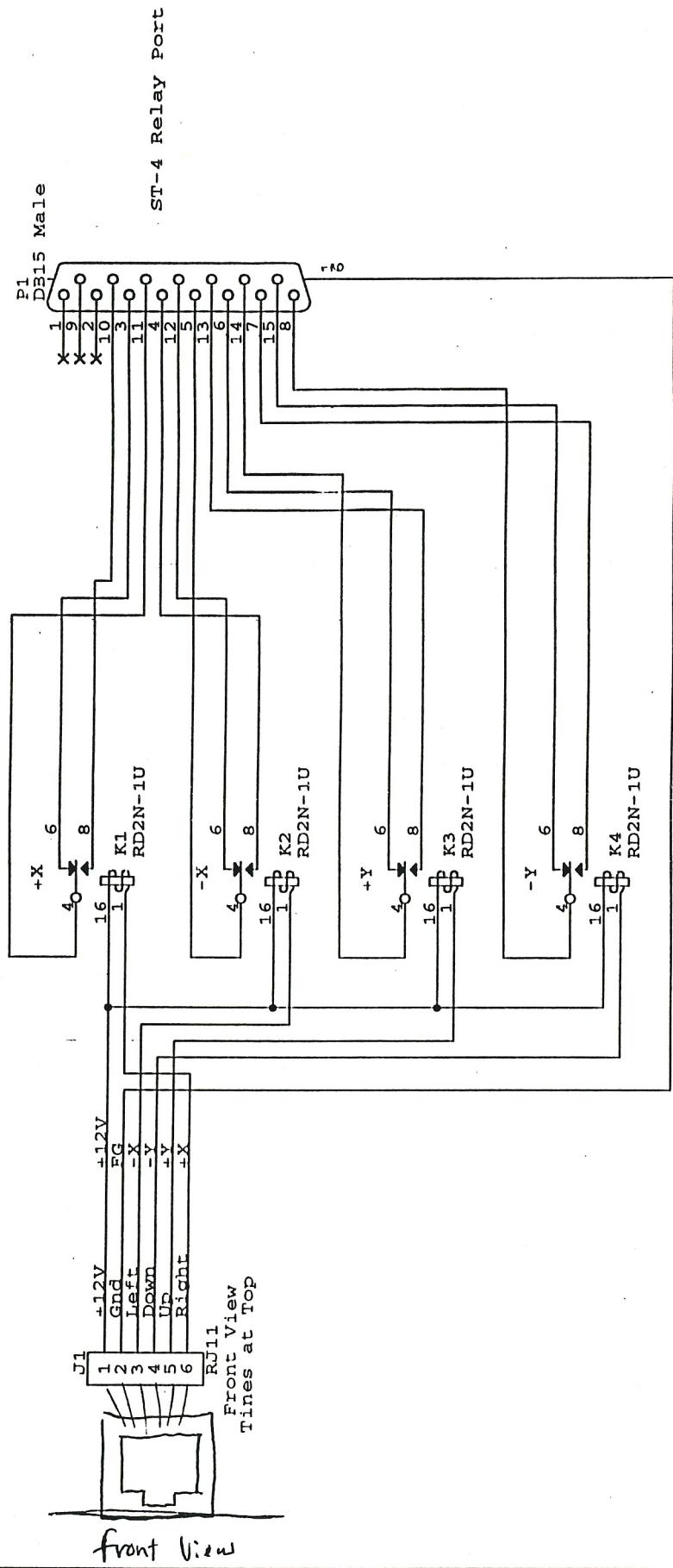
January 16, 1995

The ST-7/ST-8 Relay Adapter Box gives the ST-7 the same relay interface present on the ST-4. This accessory is handy for those users that have already modified the drive corrector to accept an ST-4 or those users that do not have the TTL interface found in the modern Telescopes.

The adapter plugs into the ST-7's telescope port and allows connecting to a CFW-6A with the dangling three-wire connector. The adapter box contains four single-pole double-throw relays that are activated by the ST-7 to slew the telescope. The 15 pin connector on the relay adapter box connects to the telescope's drive corrector. For detailed instructions on how to modify existing drive correctors please refer to section 4.4 of the CCD Operating Manual for the Model ST-7 and ST-8. Table 1 below gives the pin-outs for the 15-pin connector on the relay adapter box as well as the cable colors for the standard ST-4 flying lead Relay Cable.

Pin Number	Function	Color
11	+X, Common	Gray
3	+X, Normally Closed (NC)	Pink
10	+X, Normally Open (NO)	Tan
5	-X, Common	Brown
12	-X, Normally Closed (NC)	Yellow
4	-X, Normally Open (NO)	Violet
14	+Y, Common	Green
6	+Y, Normally Closed (NC)	Orange
13	+Y, Normally Open (NO)	Blue
8	-Y, Common	Black
15	-Y, Normally Closed (NC)	Red
7	-Y, Normally Open (NO)	White
Shell	Cable Shield/Chassis Ground	Bare Wire

Table 1 Relay Connector/Cable



NOTES: Board dimensions $3.8 \times \underline{2.5} \times 2.0$
 RJ-11 extends beyond board edge by 0.2 inches
 As viewed from in front, the RJ-11 connector,
 with the tines up has pin 1 on the left

Santa Barbara Instrument Group

Universal Belay Adapters

A	Universal Relay Number	REV B
Date:	April 24, 1996	Sheet 1 of 1