BKDS7700 Notes

A television broadcast tally system is the outgrowth of the ON AIR light over the door of every radio studio in the world. The tally system tells the camera operator when his camera is on the air, and when its not on the air (the best time to doll, pan, zoom, etc.) The tally light on the front of the camera tells the talent which camera to look at. VTRs, character generators, still stores, etc. are often tallied as well. Until recently, all tally systems were contact closures, with additional combinational (AND and OR) logic usually handled by the clever application of diodes.

Sony Serial Tally

Serial tally means that all tally indications from the switcher can be transmitted on a single RS422 cable. Serial tally is available from all DVS series switchers. The first Sony tally interface box, the BKDS6080 was designed for use especially with the DVS6000 and DVS6000C. It can tally 32 primary inputs, two M/Es, and two chroma keyers. The BKDS6080 is also used with the DVS2000C, and can be used with the DVS8000/C and DVS7000 series switchers if the limited number of tally outputs can be tolerated. One of the chorma key relays can be modified to tally a third M/E if necessary.

In the Sony scheme the tally interface box must interrogate the switcher to get the information it needs. Since this is a relatively complex operation, and could result in undesirable switcher operation if the wrong command were sent, most customers would not want to create their own tally interface.

Overview of the BKDS7700

The BKDS7700 is called a "Tally Interface Unit". The device also serves as the control interface between the DVS7000 and the Sony digital router. The primary use for this second function is to expand the number of inputs to the switcher by feeding up to 16 (currently) router outputs to the switcher.

The '7700 provides 72 dry (isolated) contact closure outputs, with an option board providing an additional 144 outputs. In addition to serial tally, parallel tally and "tally enable" inputs are also provided. There is a serial tally output, which can feed a downstream '7700 or BKDS6080 tally box.

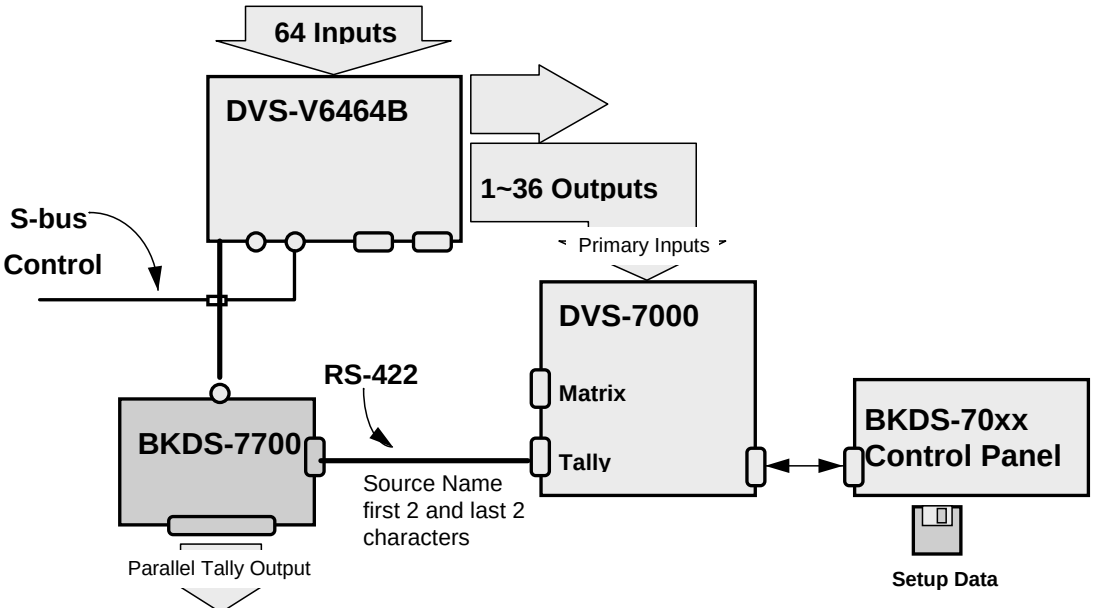

Figure 1

The Router interface is via a Sony S-bus port on the back of the ‘7700. This interface allows the DVS7000 switcher to control a router of up to 128 inputs . The interface also allows any bus on the switcher, aux bus, key bus, M/E, etc., to be controlled from router control panels. The router interface funciton is illustrated below. Router firmware must be version 2.10 or later.

Parallel Tally In

Among current products, up to and including the ‘7000 series products, only the switchers provide serial tally out. DME effects units, and DMK downstream keyers provide contact-closure tally out only. The standard parallel tally-in arrangement of the BKDS7700 is outlined in the following Figures. The inputs marked “Fixed” have fixed size in the current software. Under V1.13 software, the parallel tally inputs can be assigned to register contact closures from other devices (such as tally outputs from a non-Sony switcher). This assignment is made in blocks of 16 contacts, so it is possible to bring in up to 32 external tallys, and still accommodate the dsk and DMEs.

- **48 Input capability**
  - **4 for DMK (DSK) : Fixed**
    - Tally In 1~4
  - **12 for DME : Fixed**
    - Tally In 5~16
  - **(4 bits) x3 for *output selector**
    - P-In 1~4, P-In 5~8, P-In 9~12
  - **(4 bits) x4 for DSK *source selector**
    - P-In 12~16, P-In 17~20, P-In 21~24, P-In 25~28
  - **4 bits for chromakey *source selector**

    P-IN 29~32

    *Output/source selector : BVS-V1201/DVS-V1201

Figure 2

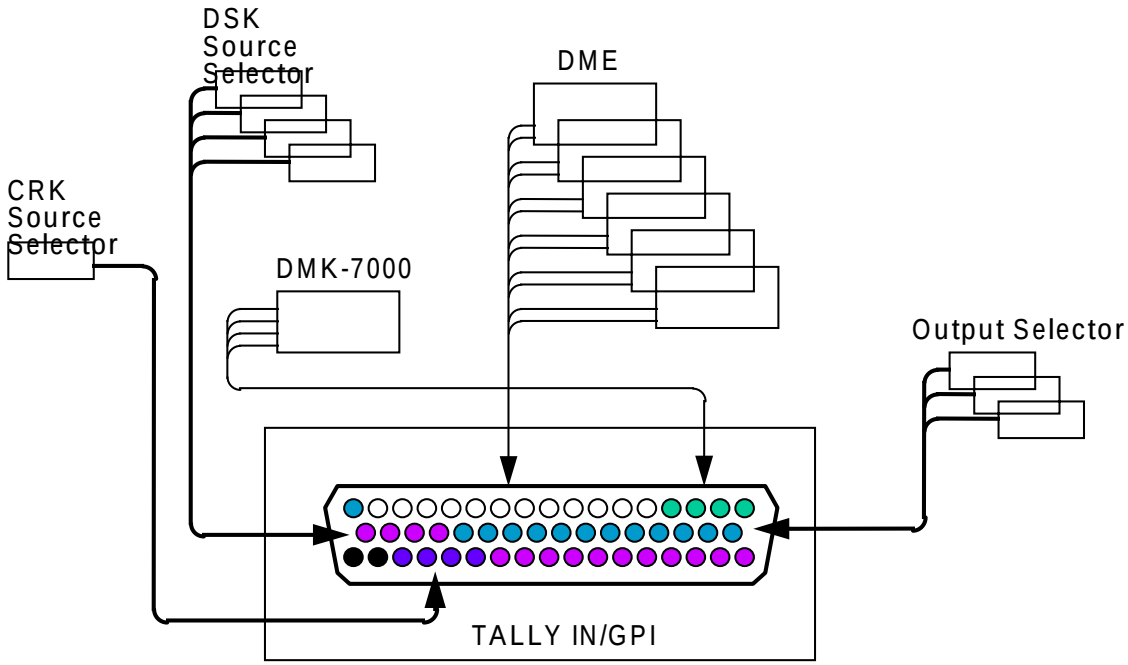

Figure 3

Tally Enable Inputs

There are 48 Tally Enable inputs. These inputs allow an external device to gate a tally function. As an example: an ISO record tally might receive a contact closure from the record VTR to indicate that it is actually recording, and pass this information on to the camera being recorded by closing the contact for a low (Green) tally on that camera.

BKDS7700 Physical

The tally box is 3 rack units high, and has 5 horizontal card slots. The bottom two slots contain the standard cards:

Slot 4	RC-65(A) (containing 72 relays)
Slot 5 (bottom)	CPU-229 (front 1/3) and IF590 (back 2/3)

Slot 1 (the top slot) is the location for the optional relay card; RC-65. The difference between the RC65 and RC65(A) is that the “A” version is only half populated, and has different firmware. The tally relays are rated 30V, 100mA. There is provision in the crate for a second psu, model BKDS7790. The second power supply is for redundancy, but also recommended for any unit with a second relay card.

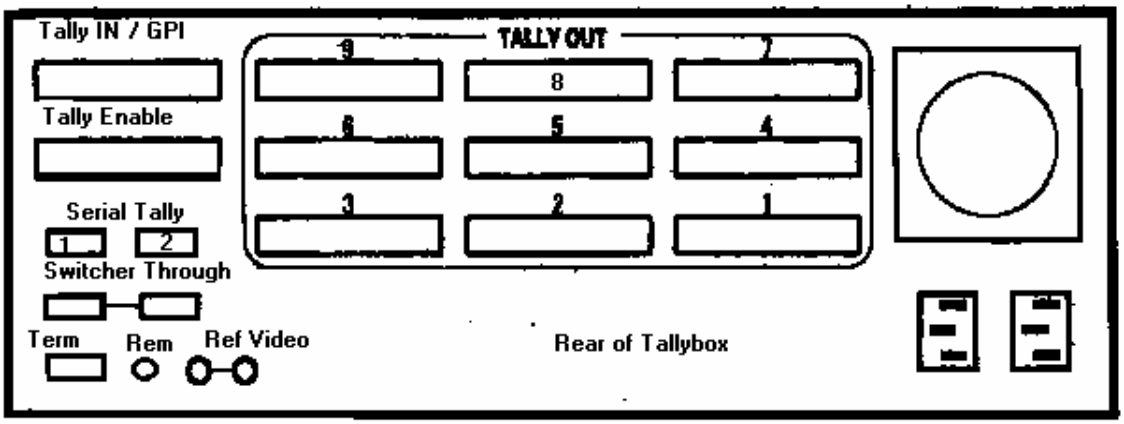

Figure 4

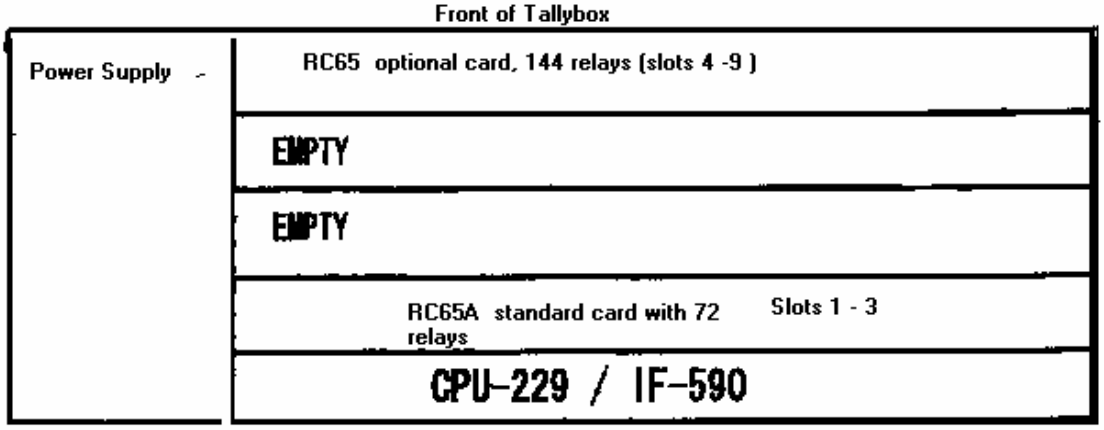

Figure 5

Loading the Operating Software

The software model number is BZS7720. You will need to use a computer to download the software to the tally box. The procedure is described in section 5 of the installation manual. Connection can be made to the 9-pin port marked “Terminal” on the back of the ‘7700 as stated in the manual, or to the port on the front of the CPU. The BZS7720 software disk 1 contains the following files:

Loader16.exe	-	the loader routine
BKDS7700.obj	-	the tally box operating software
loader16.ini	-	copy to the pc’s WINDOWS directory
ctl3d.dll	-	copy to the pc’s WINDOWS/SYSTEM subdirectory
readme.txt	-	notes on operation of the loader

If the .ini file is not present in the WINDOWS directory, you will get an error message referring to “unspecified length” when you start the loader routine. The pc’s config.sys should contain the statement: “DEVICE= C:\DOS\ANSI.SYS”. If the computer is running under Windows95, the statement should be “DEVICE= C:\WINDOWS\COMMAND\ANSI.SYS”. The setup routine may contend with Windows95 for control of the serial port. If this happens, you will not be able to read data from the Tallybox. The easiest way around this problem is to exit Windows through the Shutdown command, and reboot in the DOS mode.

Loading software into the BKDS7700 does not seem to affect setup files already in the Tallybox memory.

Setup Operations

As noted above, setup of the BKDS7700 also requires a PC. The setup program is on disk 2 of the software package.

Contents of disk 2: setup.exe - self-contained, no terminal emulator is required
tallybox.hlp - runs inside setup.exe

Disk 2 may also contain some sample setup files. These files have no extension, but can be recognized by their length: 3727 bytes in software version 1.00.

The cabling described in section 5 of the installation manual works for software installation (the Loader routine), but will not work when running Setup on most PCs. For Setup, use a Lap-link cable, or make sure that your cable has the following pinout with the jumpers on the PC side as shown below. A cable conforming to this wiring chart will work for both installation and setup.

PC Side		7700 Side
pin 2	----------	3
3	----------	2
4 -- 6	jumper	
5	----------	5
7-- 8	jumper	

Refer to section 3-2-2 of the Maintenance Manual (Part 1)

The Setup Menus

Refer to the BKDS7700 System Setup Manual for step by step setup instructions.
To run the setup program, run Setup.exe on your PC. The top menu is as follows:

1 **Read**
2 **Setup**
3 **Write**
4 **System**
5 **Single Shot**

Read (1) reads the contents of '7700 ram into the PC. You must specify a register (1-4) to be read. Long operations, such as register reads and writes can fail due to interference caused by Sbus traffic. Disconnect the Sbus if tallybox reads and writes fail. Disk files can also be read in. When reading a disc file: 1) use the softkey SEL to select a directory (if necessary), 2) hit Enter twice to make a selection, 3) hit SEL again, and repeat the procedure to select the subdirectory or file. There are . and .. selections, but attempting to use them to move back up the directory tree causes an error.

Setup (2) has the following menu:

1 **System**
2 **Address Bus**
3 **Router**
4 **Slow VTR**
5 **Wiring**

6 **Tally Data Copy**
7 **Tally Enable**
8 **Output**

System Menu:

typical values

1 Router (Sbus) ON/OFF

Set to OFF when no router is present, or you will lose the switcher names.

2 Router Level (1-8)

This is the level of the router that is interconnected with the switcher components, i.e. in a "D1" system it is the component SDI level

3 Switcher ON/OFF (if off, tallies do not transfer from the switcher to the router, and there is no control of switcher buses from the router) Set to off if there is no switcher in the system.

4 Switcher Level (1 typically)

This is the router level that the switcher, DMEs, DMK, and other components live on. Only the router may be put on a different level - though it may be on the same level.

5 Switcher Type (3.0, 3.5 M/E)

Use 3.5 M/E if the switcher has a Program/Preset bus, i.e. for both 2.5 and 3.5 M/E switchers.

6 DSK Config (Cascade, Dual Cascade, Parallel)

7 DME Type (choices are V+K and V+E+C)

Use V+E+C to provide full functionality for the DME7000 . V= video, E= external input, C= combiner.

8 Tally in/GPI type Normal, Ext1, Ext2, Ext3

Use Normal to accommodate all of the features shown in figure 2. Ext 1 provides for one 16X1 switcher in the matrix (inputs 33 - 48), Ext 2 provides for two 16X1 switchers (inputs 17 - 48), Ext 3 for three (all of the parallel inputs). These can be real 16X1 switchers, or virtual devices in the 512X512 matrix, used only to define a tally condition.

9 Tally Box 1st or 2nd

Use "2nd" only if this '7700 is connected to the serial tally output of another '7700.

10 Router I/F ON/OFF (OFF if there is no router in the system.)

If off, a) names do not transfer from the router to the switcher, b) there is no control of switcher buses from the router, c) there is no control of the router from the switcher.

11 Switcher Dest. Width 32 or 64 (64 for the DVS7000)

Address Bus Menu:

		Source	**Destination**
1	**Switcher <128X64>**	1-128	1-64
2	**Switcher XPT<128X64>**	1-128	256-319
3	**DSK <12X9>**	129 -140	65-73
4	**DME <12X12>**	141-152	74-85
5	**Output Select <12X3>**		
6	**DSK Source Sel<12X4>**		

7 CHR Source Sel <12X1>

In this menu we assign the components of the system to their locations in the 512X512 virtual router space. The Tallybox uses this router model to keep track of the inputs and outputs of the switcher, downstream keyer, and DME effects units. The router matrix scheme is used even when there is no router in the system. Values shown are typical. Components cannot overlap either vertically or horizontally, except that the router can overlap the other boxes if it is mapped into a different router level, or if inputs run in parallel to the two devices. Hit <cr> to enter a start value. Push SET (F12) to make the changes stick.

A map of the switcher input/output matrix is given in section 3 of the BKDS7700 Installation Manual. For the DMK7000 downstream keyer, the inputs and outputs are assigned as follows:

DSK OUTPUT	DSK INPUT
1 PGM1	1 PGM/BKGD1
2 PVW1	2 PST/BKGD2
3 PGM2	3 BKGD3
4 PVW2	4 EMERG/BKGD4
5 PGM3	5 DSK1 VIDEO
6 PVW3	6 DSK1 KEY
7 PGM4	7 DSK2 VIDEO
8 PVW4	8 DSK2 KEY
9 CLEAN	9 DSK3 VIDEO
	10 DSK3 KEY
	11 DSK4 VIDEO
	12 DSK4 KEY

The DMEs are mapped togehter, in a single block of inputs and outputs. With DME-TYPE set to V+K, each DME has one video input and one key input mapped into the matrix. The inputs and outputs are mapped as shown in the following table. Note that in version 1.0 software, this is the only DME mapping available.

DME OUTPUT	DME INPUT	TALLY IN/ GPI
1 DME1 VIDEO	1 DME1 VIDEO	pin 5
2 DME1 KEY	2 DME1 KEY	6
3 DME2 V	3 DME2 V	7
4 DME2 K	4 DME2 K	8
5 DME3 V	5 DME3 V	9
6 DME3 K	6 DME3 K	10
7 DME4 V	7 DME4 V	11
8 DME4 K	8 DME4 K	12
9 DME5 V	9 DME5 V	13
10 DME5 K	10 DME5 K	14
11 DME6 V	11 DME6 V	15
12 DME6 K	12 DME6 K	16

With DME-TYPE set to V+E+C, each DME has one “front-end” video input, a combiner input, and an external video input mapped into the matrix. Since the 12 input by 12 output block size of DME remains the same, only 4 channels of DME can be accommodated in this mode.

S-Bus Matrix for the "V+E+C" mode:

Source	Destination
1 DME1V	1 DME1V

2 DME1E	2 DME2V
3 DME1C	3 DME3V
4 DME2V	4 DME4V
5 DME2E	5-12 (No use)
6 DME2C	
7 DME3V	
8 DME3E	
9 DME3C	
10 DME4V	
11 DME4E	
12 DME4C	

TALLY IN/GPI connector for the "V+E+C" mode

1 DME1V
2 DME1E
3 DME1C
4 DME2V
5 DME2E
6 DME2C
7 DME3V
8 DME3E
9 DME3C
10 DME4V
11 DME4E
12 DME4C

If an output selector is used downstream of the switcher or downstream keyer, its virtual matrix size is 12 in by 3 out. A DSK source selector is allocated 12 in by 4 out. A chromakey source selector is 12 in by 1 out.

SETUP: **Router**

The Router menu has Source and Destination sub-menus. Each menu is a table which matches, or can remap and restrict, switcher control of the router physical inputs (Source) or outputs (Destination) with an S-Bus address. The addresses can be the same as those entered in the DVS3232 or DVS6464 router's own "Physical" table, or the entries can be rearranged to map only those inputs and outputs of interest to the switcher.

Source Menu

Display = Router : S-Bus
1:201 2:202 3:203 .....8:208
.....
.....

where the first number is the router physical input, and the second number is the S-Bus address

Destination Menu

1:101 2:102 3:103.....

Here the first number is the router physical output, the second the S-Bus address of that output. To change a setting: ENTER, arrow to selection, type in new number, ENTER, hit the softkey marked SET.

Setup : **Slow VTR**

	Destination
1 **Slow VTR 1**	71 (Pgm out)
2 Slow VTR 2	17 (Aux 1 out)
.	
.	
.	
16 (16 possible "Slow VTR" assignments) (more in V1.13)	

In this menu we flag those outputs that we want to cause either a red, green or yellow tally. Typically Red is set to the final Program output (71 in the example above, the DMK dsk 4 pgm output), and Green, if used, is set to the addresses of router or Aux bus outputs that feed ISO VTRs, etc. A camera would then tally green if its output were being recorded. The Slow VTR definitions are used in the Tally Enable menu.

Setup: **Wiring**

This menu describes physical connections (wires) between the various system components. This includes all video cables that both start and end at devices mapped into the 512X512 matrix. Include PGM (the wire from PST out of the switcher to BKGND2 of the DSK is ignored, this connection is assumed if PGM is connected to BKGND1), AUX lines from the switcher to the downstream keyer, Aux outputs to the DMEs, DME returns to the switcher, and DME combiner wiring.

Display = Source : Destination

1:101 2:102 3:103 4:104.....

(Note that, from the point of view of video signal flow, the first entry "Source" is the 'to', and the second entry "Destination" is the 'from'. This is the case because the terms refer to the sources and destinations of the 512X512 virtual router matrix that the Tallybox lives in. As an example 1:101 means that output 101 [a router output] is tied back to input 1[primary 1 of the switcher].

Setup: **Tally Data Copy**

<Display = From Tally No. : To Tally No.>

Tally data copy allows a video feed that enters the virtual matrix on two different inputs to be tallied on a single relay, e.g. the router and switcher each receiving the same feed. The second number (To Tally No.) is the source that is associated with a relay in the Output menu, the first entry (From Tally No.) is the matrix Source number of another input we want to trip the same tally relay. In some instances it may to be necessary to have pointers going in both directions, e.g. if a source is to be tallied both through the tallybox outputs, and through the router display tallies.

Setup: **Tally Enable**

1) Red
2) Green
3) Yellow
(select one of the above):

Red Tally	**<1>**	**<2>**	**<3>**	**<4>**
type		**Slow1**	**.....**	
enable no.	**EBL**			

(here the entry "Slow 1" is as described in the table in menu Slow VTR)
EBL means always enabled, in another case a specific Enable input could be specified, such as REC tally out of a VTR, or ONAIR tally back from master control.

The Tally Enable selections are:

EN-no. DEL Line Slow PP M/E ALL AUX

EN-no. (sets the number of the enable connector input which will gate this tally)

DEL (no enable)

Line (a downstream output selector)

Slow (a destination on the 512X512 matrix as defined in the Slow VTR menu)

PP (the program / preset bus)

M/E (select M/E 1 -3)

ALL (all switcher buses - does not include DSK)

AUX (aux bus)

Setup: **Output**

1	**Serial Tally 1**	**-------**
2	**Serial Tally 2**	**-------**

Hit <cr> to enter a serial tally menu. In these menus the functions of the two serial tally outputs can be mapped seperately. Select Red, Green, or Yellow tally, and enter the source numbers to correspond to the tally positions.

3	**Tally Out 1**	**Red**
4	**Tally Out 2**	**Red**
5	**Tally Out 3**	**Red**
6	**Tally Out 4**	**Green**
7	**Tally Out 5**	**Green**
8	**Tally Out 6**	**Green**
9	**Tally Out 7**	**-------**
10	**Tally Out 8**	**-------**
11	**Tally Out 9**	**-------**

"Tally Out" numbers (entries 3 through 11) refer to the 9 50-pin D connectors on the back of the '7700. Moving the cursor to one of the Tally Out selections causes the assignments for the corresponding connector to be displayed in a table :

TYPE: .....

Pin no. : Tally no.

	1:201	**2:202**	**3:203**	**4:204**	
.....					
	.....	**.....**	**.....**	**.....**	**24:**
.....					

In the first entry "1" refers to the first relay output on this tally connector (even though its marked "Pin no." it is not the pin number directly). "201" refers to Source (input) 201 of the virtual matrix. In this example Source 201 is the input to the router. Therefore, if this were designated a red tally connector, relay 1 would close whenever the video feeding virtual matrix input (Source) 1 was on-air. The relay to pin number map is given in section 1 of the installation manual. TYPE defines the output condition that tallies back, e.g. Slow1, Slow2, Red, Green, Aux, etc. Push the SET softkey to enter the table.

Back at the top menu:

Write

1) FDD (writes to a disc on the PC - hard drive or floppy)
2) Tally box (writes to ram in the '7700)

System

1) Used Register (defines the register (1-4) to be used at startup)
(startup register can also be selected from the front panel)
2) Save Flash Ram (writes all 4 registers from ram to flash. This must be done to make changes permanent. The LCD window in the tallybox will indicate that the Flash write is happening)

Single Shot

The SINGLE SHOT menu has the same selections as the Setup menu. The difference is that it allows you to set a few values and 'overwrite' (using its own WRITE command) these new values with the current data in the tally box ram. This is not a write to flash, however. You still need to go back to System:Save Flash Rom to save the changes permanently.

Tallybox Front Panel Menu

The front panel of the BKDS7700 has its own menu. Using the two pushbuttons on the front of the panel, the following information can be displayed and manipulated:

Top menu: **Information** **TallyI/F Unit** **Setup Reg** **Testmode** **LCD Contrast**

Scroll through these top menu items with the left key and enter one with the right key.

Information - provides the firmware version number

TallyI/F Unit - displayed when menu not in use

Setup Reg

- **Reg** - select register 1 - 4 to be used
- **Change Reg** - execute the selection made

Testmode

- **Tally Out** (trigger a relay)
  - **1-01** (trigger connector 1, relay 1)
    1-...
    1-24 (24th relay on connector 1)
    1-Q (Quit out of the first connector)
    1 (first connector)
    2 (second connector, hit enter to move into the menu for the second connector relays)
    ...
    9 (9th connector)
    Q (quit back to Testmode)
- **Parallel In**
  - **Tally In/GPI**
    - 0000 0000 0000

(this is a hex readout of the condition of the parallel tally inputs, coded as follows:

tally input 1	DSK1	0000 0000 0001	numbers add when more than one
tally input 2	DSK2	0000 0000 0002	tally is being received
tally input 3	DSK3	0000 0000 0004	(DSK1 and DSK2 on = 3)
tally input 4	DSK4	0000 0000 0008	
tally input 5	DME1V	0000 0000 0010	
tally input 6	DME1E	0000 0000 0020	
tally input 7	DME1C	0000 0000 0040	
tally input 8	DME2V	0000 0000 0080	
tally input 9	DME2E	0000 0000 0100	
tally input 10	DME2C	0000 0000 0200	
tally input 11	DME3V	0000 0000 0400	
tally input 12	DME3E	0000 0000 0800	
tally input 13	DME3C	0000 0000 1000	the pattern extends through the
tally input 14	DME4V	0000 0000 2000	msb for higher number inputs
tally input 5	DME4E	0000 0000 4000	
tally input 6	DME4C	0000 0000 8000	

- **Tally Enable**
  - 0000 0000 0000

(a hex readout of the Tally Enable inputs)

- **LCD Contrast** (adjusts the display)

Other Notes

Volume 2 of the Tallybox maintenance manuals has been released as Supplement-1 to the 6 volumes of DVS7000/DMK7000/DVS1000 master manual set. The installation manual and volume 1 of the maintenance manual are stand-alone documents.

Pressing the “Abort” switch on the CPU board puts the CPU into monitor mode. There is a menu of CPU tests in this mode - similar to other Sony CPUs. There is also a set of test routines in the Tallybox software. Use of these routines is described in the maintenance manual part 1.

The router must be mapped the same as the tally box, i.e. it must locate itself and the other devices in a 512X512 grid. This is done from the normal router menu. The BZR1000 router control scheme cannot be used for this application. Note that the physical assignment table of the router (menu L) is ignored by the tallybox. This means that source names sent to the tallybox for display on the switcher must appear in the router’s source name table in their correct position in the tallybox virtual router matrix.

In the Switcher

Setup

Router outputs must be matched to the primary inputs that they feed in the menu **Router I/F** under **Setup**. This function is comparable to that of the menu “Wiring” in the tallybox setup. The SEL softkey copies the highlighted router output in the Router Dest select box to the “Router Dest” slot of the highlighted switcher input:

Setup: Router I/F

Swr Input	Source Name	Router Dest.		Router Dest
Pri 1	VTR1	Out 1		Out 1
Pri 2	VTR2	Out ...		Out 2
.....	.....	.....		.....
.....	.....	.....		Out 16 (select box)

Source names assigned in the router transfer to the switcher (first 2 characters and last 2 characters). Use “no connect” in this menu for inputs not connected to the router.
Setup: Crosspoint Assignment

If the tally system includes a router, go to the Multi Xpt menu and assign crosspoints for Serial Tally as shown on Page 5-8 of the BKDS-7700 Installation Manual. The information is incomplete in the first edition of the Installation manual, however. Refer to SWEM 96-905 for the complete table. For the DVS7200 the correct table is given in the User’s guide.

Operation

Operation of the router matrix from the switcher is done from the Menu “Router Control”. This menu is accessed by pressing the bottom right button on the EL-Display panel. This button is unmarked on most switchers currently in the field (the row is marked “Utility”).

Router Control

Destination	Source		Source (select box)
Out 1	VTR3	|	VTR1
Out2	CAM5	|	VTR2
Out3	VTR3	|	VTR3
.....	.....	|	.....
.....	.....	|	IN32 (for a 32X router)

This menu works like most DVS7000 selection menus.

Tallybox Software Versions

At the last revision of these notes, the following software versions are in the field:

V1.00 First release
V1.01 Supports DME Combiner and External Input On-Air tallys. *
V1.02 V+E+C mode, bug fixes in Sbus communications.
V1.10 Not generally released, this version has been installed in sites having more than one BKDS7700 on a single Sbus. Sbus firmware must be changed to V1.10.
V1.13 Released from Japan with documentation support. Supports “external box” parallel inputs. Requires V1.10 Sbus prom.

*V1.00 Setup.exe can read setup registers from a BKDS7700 running V1.01, but cannot read disc files written under V1.01.
*V1.01 Setup.exe can read setup registers from a BKDS7700 running V1.00, but cannot read disc files written under V1.00.
(These restrictions appear to follow generally from one software version to the next)

Physical Wiring

Pinouts for the tallybox connectors are detailed in the Tallybox Installation Manual, shipped with each BKDS7700 tallybox. Parallel tally and tally enable inputs are mapped in order from pin 1, with pins 49 and 50 common.

The following table shows the parallel tally wiring from the DMK7000 and up to four DME7000s to the BKDS7700. This information is represented schematically in the drawing on the following page. This drawing is from the Tallybox Setup Manual.

Tallybox Parallel In 50 pin D			DMK7000 Tally/GPI 25 pin D	
pin	1	DSK 1	7 A side	19 B side of relay
	2	DSK 2	8	20
	3	DSK 3	9	21
	4	DSK 4	10	22
49 or 50		common	tie to B sides of DMK relays	

DME7000
GPI Out
15 pin D

5	DME 1 V	2	tallys main video on screen	9	B side
6	DME 1 E	3	tallys external video on screen	10	
7	DME 1 C	4	tallys when combiner is on (not in isolate)	11	
8	DME 2 V	2	second DME	9	
9	DME 2 E	3		10	
10	DME 2 C	4		11	
11	DME 3 V	2	third DME	9	
12	DME 3 E	3		10	
13	DME 3 C	4		11	
14	DME 4 V	2	fourth DME	9	
15	DME 4 E	3		10	
16	DME 4 C	4		11	
49 or 50	common, connect to the B side of all DME relays				

50 Pin Female D connector viewed from chassis rear

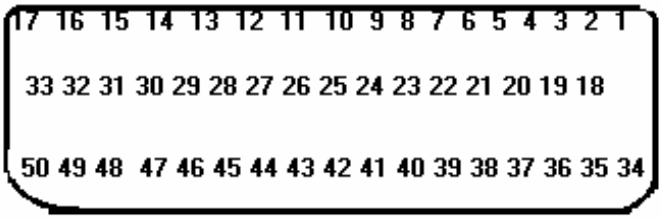

Figure 6

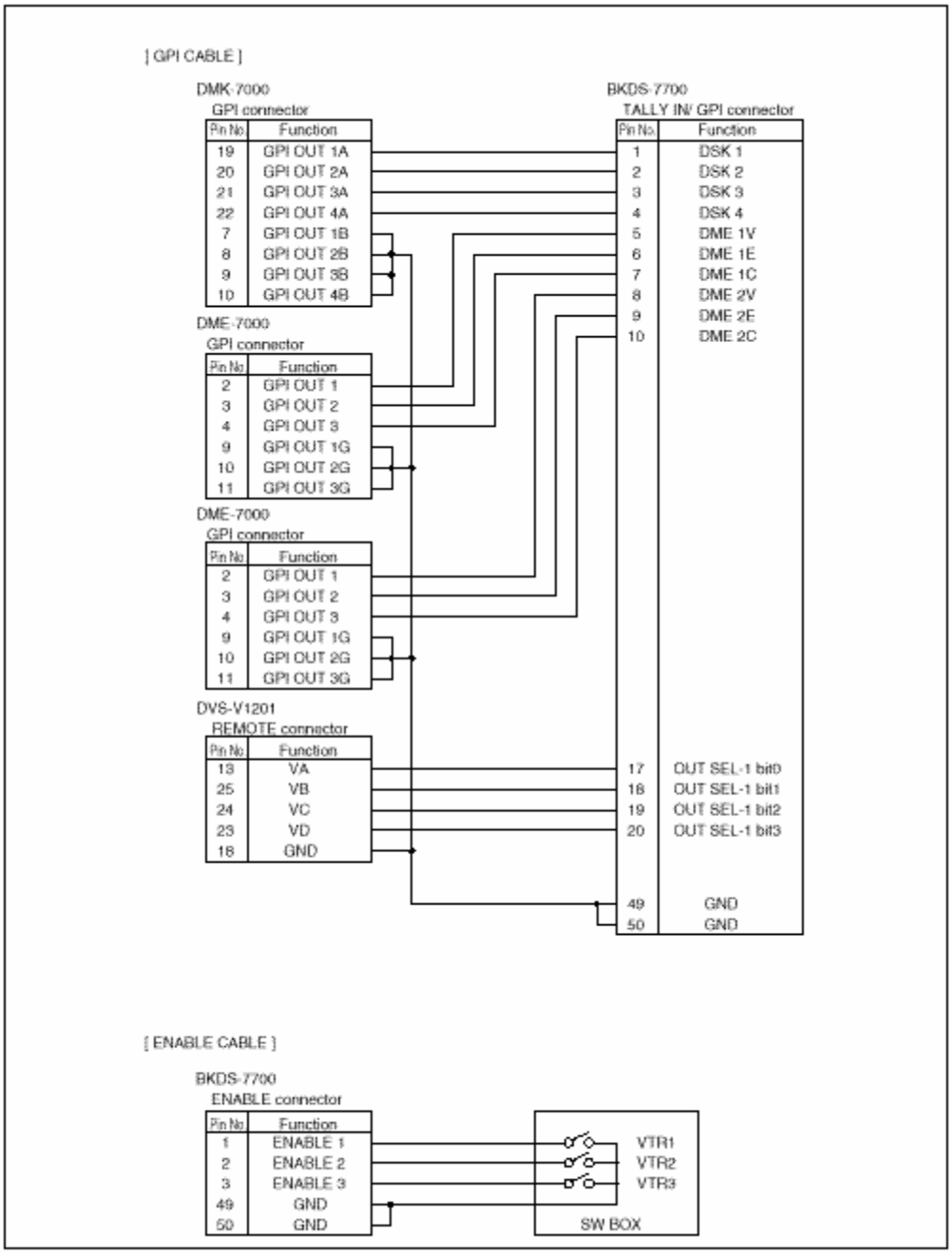

Figure 7 DMK/DME Parallel Tally Wiring

Revisions

7/7/97	added DME tally connections	DQ
12/15/97	added introduction, chassis drawings, V1.02 software changes, wiring table	DQ
4/3/98	added reference to Setup manual	DQ
7/2/98	corrected and expanded front panel test information	DQ
7/22/98	revised tally-in and router setup, added figure numbers	DQ