

8 DBRA (Data Bridge Card) Startup and Configuration Guide Ver 2, April, 2011

There are 2 version of the 8DBRA card, one with 2 RJ45s and 2 HD44 connectors that require 2 fanout cables, each with one DE9 and 2 DB25s. The other card has 8 RJ45 connectors. The all RJ45 version is preferred because the connectors are all the same. The card supports transmit data, receive data and ground on each port. RS232 control leads are not supported.



The 8DBRA card with the 8 RJ45 connectors provides easier, cleaner looking connections.



The 8 DBRA card supports asynchronous ports at any <u>speed up to 19,200 bps</u>. The speed setting in the 8DBRA card setup screen is for reference only.

The 8DBRA card is compatible with other 8DBRA cards and any <u>synchronous RS232 56Kbps or 64 Kbps</u> card or 56K or 64K OCUDP from Loop or other manufacturers (tested!). The 8DBRA card uses oversampling. See Page 16 for a description of the oversampling technique. Terminal devices attached to non-8DBRA cards must run at the same speed as the devices attached to the 8DBRA cards.

The 8 ports of the 8DBRA can be <u>mapped into 3 or 4 Virtual Ports (VP)</u>. If the 8DBRA card is configured for "NO Backup" or "1+1 Port Backup", all 4 of the Virtual Ports are available. Backing up the entire card in the same or a different chassis limits the card to 3 virtual ports. Data is carried to the backup card, whether in the same chassis or to a remote site, via one of the Virtual Ports (VP4).



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The 8 DBRA card has 32 time slots for each Virtual Port, for a total of 128 time slots. Any one of the RS232 ports can be mapped to maximum of 20 downstream endpoints (DS-0s) on a multidrop circuit.

Mapping is a 2 step process. The first step is to map the physical RS232 ports to virtual ports, then map the virtual ports to one or more DS-0s. The card mapping is a sub menu for the card slot. The Virtual Port mapping is done at the AM3440 system time slot interchange (TSI) mapping level.

The 8 DBRA card <u>protection mode</u> allows port/card protection on the same card, on a different card in the same chassis, or on a different (remote) chassis.

The 8DBRA card can be used at a central host site, a midpoint remote drop location, or endpoint remote drop location.

At a host site, backup may be:

- To the backup ports (ports are paired 1 and 5, 2 and 6, 3 and 7, 4 and 8).
- To a second card in the same chassis. Card slots are paired 1&2, 3&4, 5&6, etc.
- To a second card in a different chassis at another location

At a remote drop site (downstream location), backup may be:

- To the backup ports (ports are paired 1 and 5, 2 and 6, 3 and 7, 4 and 8).
- To a second backup card in the same chassis

All 8 ports of the 8DBRA card can be mapped to different locations unless the card is set for 1+1 port backup, 1&5, 2&6, 3&7, 4&8 are paired, limiting the ports to 4 pairs.

The 8DBRA card can be used as a host end digital bridge device or an 8 port asynchronous data card. The 8DBRA card is most useful, and is unique for its function as a host digital bridge device, where data from a host computer attached to one of the RS232 host ports is broadcast out to as many as 20 endpoints. At the card level, RS232 ports are mapped to Virtual Ports (VPs). At the Time Slot Interchange (TSI) map level, the Virtual Port (VP) time slots are mapped to DS-0s on T1/E1/FOM circuits. Therefor mapping is a 2 step process.

If a card is used as an 8 port asynchronous port card only (not for its bridging capability), each port is mapped to a different time slot on a Virtual Port. As an 8 port asynchronous card in a point to point application, only 8 of the 128 time slots are used. Only one Virtual Port (VP) needs to be used.



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Step One, setting up the card mode for 56 Kbps or 64 Kbps operation:

The 8DBRA card can be set to over sample at either 56 Kbps or 64 Kbps. All 8 ports share the same sampling rate of either 56 Kbps or 64 Kbps. After the card is changed from one rate to the other, it is necessary to reset the card.

When the 8DBRA card is reset, all card mapping is set to default (no mapping). The card reset takes about 50 seconds to complete. Be patient.

Below are the screens showing the "M \rightarrow Mode Setup" selection, the 56/64K selection.

SLOT 5 8DBRA	P1	=== Port	Menu ===	13:51:15 04/03/2011
Version	: SW V1.02.01 03, HW Ver.B FPGA	/31/2011 Ver.B		
Backup Mode:	NO (64K)			
[DISPLAY]			[SETUP]	
T -> Port Map	Configuration		<u>M -> Mode Setup</u>	
C -> RS232 Cc	onfiguration		B -> Backup Setup	
			K -> Port Map Setur	2
			S -> RS232 Config S	Setup
			G -> Upgrade Firmwa	are

SLOT S ARROW	5 8DBRA P1 KEYS: CURSOR MOVE, TAN	=== Mode Setup === B: ROLL OPTIONS	13:51:30 04/03/2011
<u>Mode:</u>	<u>64K</u>		
<u>Note:</u>	Change Mode will rese	<u>card</u>	

Card reset celars all 8DBRA card mapping (8DBRA ports and time slots to Virtual Ports). The reset process takes a bit less than one minute.



Simple Application of the 8DBRA, single host location only:



SCADA Primary & backup hosts

First, note that the chassis has 8DBRA cards in slots 3 and 4.

LOOP 12/0	AM3440-C 1/2010	===	Information Summar	y === 11:54:00
Slot ==== A B C D	Card/Interface ======= FOM	Serial ===== N/A	Software Version	Registered Card ====== FOM
1	Quad T1	002095	V3.02.03 07/30/2010	Quad T1
2	E&M	001937	V4.02.02 07/30/2010	E&M
3	8DBRA	N/A	v1.01.01 05/05/2010	8DBRA
4	8DBRA	N/A	v1.01.01 05/05/2010	8DBRA
5	FXS	002097	V3.01.03 07/30/2010	FXS

Next, select a card. From the main menu, "U" and "3" for slot 3. No backup mode selected yet.

SLOT 38DBRA P1=== Port Menu ===11:57:4412/01/2010Version: SW V1.01.0105/05/2010
HW Ver.BFPGA Ver.ABackup Mode: NO[SETUP][DISPLAY][SETUP]T -> Port Map Configuration**B** -> Backup Setup
S -> RS232 Config Setup
L -> Loopback Test



G -> Upgrade Firmware

Select "B - > Backup Setup" Select "1+1 Port Backup". This selection pairs ports 1 & 5, 2 & 6, 3 & 7, 4 & 8. They are digitally bridged together.

SLOT 3 8DBRA P1=== Backup Setup ===12:01:19 12/01/2010ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

Backup Type : 1+1 Port Backup

Warning!! Change Backup Type will clear map.

Next you can select "S - > RS232 Config Setup". This is reference only. The card supports any async speed up to 19200 bps regardless of what is on this screen.

 SLOT 3 8DBRA P1
 === RS232 Setup ===
 12:04:25 12/01/2010

 ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

RATE : 9.6KBps

Interface : 8RJ

Back out to the Port Menu and select "K - > Port Map Setup" See the port map setup on the next page. You will need to map only ports 1, 2, 3 and 4.

In the example below, RS232 (the physical port) is mapped to time slots 1, 2 and 3 of Virtual Port 1. This will allow the data from RS232 port 1 to be mapped to 3 different DS-0s. Use the arrow keys to move down the screen from Virtual Port, to TS start, to Total TS, RS232 Port and Command. When you get down to "Command : Set", use the "Enter" key to accept the selection. Using the arrow key does not accept the mapping.



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SLOT 3 8DBRA P3 === Port Map Setup === 13:31:19 12/01/2010 ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS [Setup] Virtual Port: P1 TS start : 01 Total TS : 01 RS232 Port : 1 Command : Set [Display] Port TS: 1 9 17 25 32 VP1 MAP: 111 iiii iiiiiii iiiiiiii iiiiiiii VP2 MAP: iiiiiiii iiiiiiii iiiiiiii iiiiiiii VP3 MAP: iiiiiiii iiiiiiii iiiiiiii iiiiiiii VP4 MAP: iiiiiiii iiiiiiii iiiiiiii iiiiiiii Note: i=idle, 1~8=RS232 port number

After the RS232 ports are mapped to the Virtual Ports, back out to the Main Controller Menu, then select "S - > System Setup" and "C - > TSI Map Setup". Map the Virtual Ports to the appropriate DS-0s.

In the example below, Virtual Port 1 of the 8DBRA in slot 3 is mapped to DS-0 number 1 on 3 different T1 circuits on the Slot 1 Quad T1 card. PO is the port, TS the time slot, SL is the slot number. Immediately below is a snapshot of the key data from the TSI mapping page.

8 DE	BRA		Qua	d 1	[1
===		===	====	===	===
PO/	/TS	D	SL/	PO	TS
1	1	d	1	1	1
1	2	d	1	2	1
1	3	d	1	3	1

When mapping the System Time Slot Interchange (TSI), you are always mapping 8DBRA virtual ports. The first column above labeled "PO" under 8DBRA is the Virtual Port number. RS232 ports were previously mapped to the virtual ports using the card slot sub menu. See the top of this page.



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The full DS-0 TSI mapping page is shown below:

LOOP AM3440.	-C	===	- System	Setup (MAP) ===	13:47	:09 12/01/2010
ARROW KEYS:	CURSOR 1	MOVE, TAB:	ROLL O	PTIONS			
MAP NO: MAP	1						
-	_ Target	8bdra			Source		
Target	PO/TS D	SL/PO TS	PO/TS D	SL/PO T	S PO/TS E	SL/PO TS	PO/TS D SL/PO TS
Slot : 3							
Port :	1 1 d	1 1 1 1	17 d				
T.S. : 01	1 2 d	1 1 2 1	18 d				
	1 3 d	1 1 3 1	19 d				
	4 d	l	20 d				
T.S.# : 1	5 d	l	21 d				
Clear : No	6 d	l	22 d				
d/v :d	7 d	l	23 d				
	8 d	l	24 d				
	9 d	l	25 d				
Source	10 d	l	26 d				
Slot : A	11 d	l	27 d				
Port :	12 d	l	28 d				
T.S. : 01	13 d	l	29 d				
	14 d	l	30 d				
Confirm?Yes	15 d	l	31 d				
	16 d	l	32 d				



Since 1+1 Port Backup was selected, host ports 1 & 5, 2 & 6, 3 & 7, 4 & 8 are bridged. Host data transmitted into either port and is received downstream via the Virtual Port time slots mapped to the T1 DS-0s. Remote terminal responses are received on both of the paired ports.

In summary, follow these steps:

- 1. Select the backup type.
- 2. Map RS232 ports to the Virtual Ports through the card slot sub menu.
- 3. Map the Virtual Ports to the T1/E1/FOM time slots on the System Setup TSI Map Setup.



Mid point 8DBRA with local RTU and data passed downstream:



The host is presumed to be mapped per the first example on pages 2 through 6. The midpoint AM3440 will have an 8DBRA card and a Quad T1 card. We want to do the following:

Set the 8DBRA card for 1+1 Port Backup

On the 8DBRA Port Map Setup, map RS232 port 1 to the upstream host T1 to the AM3440. On the 8DBRA Port Map Setup, map RS232 port 2 to the downstream T1 to the V4200

```
SLOT 3 8DBRA P1
                              === Backup Setup ===
                                                             14:13:33 12/01/2010
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS
Backup Type : 1+1 Port Backup
SLOT 3 8DBRA P1
                             === Port Map Setup ===
                                                             14:14:01 12/01/2010
ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS
[Setup]
Virtual Port: P1
TS start : 01
Total TS : 01
RS232 Port : 1
Command : Set
[Display]
Port TS: 1
                  9
                          17
                                    25
                                            32
VP1 MAP: 1iiiiiii iiiiiiii iiiiiiii iiiiiiii
<u>VP2 MAP: 2</u>iiiiiii iiiiiiii iiiiiiii iiiiiiii
VP3 MAP: iiiiiiii iiiiiiii iiiiiiii iiiiiiii
VP4 MAP: iiiiiiii iiiiiiii iiiiiiii iiiiiiii
```

Two different Virtual Ports (VP1 and VP2) are used in the above example. VP1 only could have been used, with RS232 port 1 mapped to VP1, Time Slot 1, and RS232 port 2 mapped to VP1, Time Slot 2.



The screen below shows that the 8DBRA RS232 Port 1 is mapped to Virtual Port 1, and VP 1 is mapped to the Slot 1 Port 1 DS-0 number 1, which is a Quad T1 card. This time slot goes upstream toward the host.

LOOP AM3440-C ===	System Configuration	(Map) === 14:18:05 12/01/2010
ARROW KEYS: CURSOR MOVE, 7	TAB: ROLL OPTIONS	
Map Number:MAP_1		
Slot Number: 3 8BDRA	PO/TS D SL/PO TS	PO/TS D SL/PO TS
Port Number:VP1		===== =======
	<u>1 1 d 1 1 1</u>	17 d
	2 d	18 d
	3 d	19 d

The screen below shows that the 8DBRA RS232 Port 2 is mapped to Virtual Port 2, and VP 2 is mapped to the Slot 1 Port 2 DS-0 number 1, which is a Quad T1 card. This time slot goes downstream toward the V4200.

LOOP	AM3440-	-C	===	= System	Con	figu	rat	ion	(Map)	===	14:18:05 12/01/2010
ARROV	V KEYS:	CURS	OR MOVE,	TAB: ROI	L O	PTIO	NS				
Мар	Number	MAP_	1								
		_									
Slot	Number	: 3	8bdra	PO/5	rs d	SL/	PO	TS	PO/TS	S D a	SL/PO TS
Port	Number	VP2		====				==			=======
				2	1 d	1	2	1	17	/ d	
					2 d				18	3 d	
					3 d				19	d	

Data from the host comes out RS232 Ports 1 and 5 because of the 1+1 Port Backup. RS232 Port 1 can be connected to a local RTU. To get data downstream, connect RS232 Port 5 to RS232 Port 2 or 6 with a 3-wire RJ45 to RJ45 crossover cable. See the table on page 1 for pinouts. Connect the ground 1 to 1 or 7 to 7. Connect 3 to 5 and 5 to 3 to cross the data leads.







First, set the Backup on the Primary Host of a Dual Host system.



Map the RS232 ports to the Virtual Ports. There are 3 Virtual Ports available. VP4 is used to map the card to the Secondary backup site.



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In the example below, RS232 ports 1 and 2 each have 2 time slots mapped. RS232 Port 1 is mapped to VP1, RS232 Port 2 is mapped to VP2. Alternatively, both RS232 ports could be mapped to VP1, where RS232 Port 1 uses VP1, Time Slots 1 and 2, RS232 Port 2 could use VP1, Time Slots 3 and 4 (or any other, but consecutive time slots are easier to track.

SLOT 3 8DBRA P1 === Port Map Setup === 16:38:15 12/01/2010 ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS [Setup] Virtual Port: P1 TS start : 01 Total TS : 01 RS232 Port : 1 Command : Set [Display] Port TS: 1 9 17 25 32 **VP1 MAP: 11**iiiiii iiiiiiii iiiiiiii iiiiiiii VP2 MAP: 22 iiiiii iiiiiiii iiiiiiii iiiiiiii VP3 MAP: iiiiiiii iiiiiiii iiiiiiii iiiiiiii Note: i=idle, 1~8=RS232 port number

Map the Virtual Ports VP1 and VP2 shown above to the appropriate T1 DS-0s that go out to the remote locations. The map below has VP1 mapped to the Quad T1 Port 1, time slots 1 and 2.

LOOP	AM	3440	-C				===	= Syste	∋m	Setup	(MA	P)	===		1	6:4	3:13 1	2/()1/20	10
ARROV	ΝK	EYS:	CURSO	R M	IOVE	: , 1	TAB	ROLL	OI	TIONS										
MAP 1	:01	MAP	1																	
		-		t		8BI	DRA					So	urce	€						
Targe	et		PO/TS	D	SL/	'PO	TS	PO/TS	D	SL/PO	TS	PO	/TS	D	SL/PO	ΤS	PO/TS	D	SL/P	O TS
Slot	:	3		==					==			==		==				==		
Port	:		<u>1 1</u>	d	1	1	1	17	d											
T.S.	:	01	<u>1 2</u>	d	1	1	2	18	d											
			3	d				19	d											
			4	d				20	d											
T.S.‡	# :	1	5	d				21	d											
Clear	r :	No	6	d				22	d											
d/v	:	d	7	d				23	d											
			8	d				24	d											
			9	d				25	d											
Sourd	ce		10	d				26	d											
Slot	:	1	11	d				27	d											
Port	:	P1	12	d				28	d											
T.S.	:	01	13	d				29	d											
			14	d				30	d											
Confi	irm	?Yes	15	d				31	d											
			16	d				32	d											
<< P1	res	S ES	C to re	etu	irn	to	Cor	ntrolle	-r	Setup	men	111.	ther	ηI	Press	$D \pm c$	o acti	ve	>>	



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Map the Virtual Port 4 to the T1 that connects to the Secondary Backup site. The example below shows 2 DS-0s mapped over a T1 to the backup site. The 2 DS-0s are necessary because there are 2 Virtual Ports used on the 8DBRA Primary Site card that are also directed to the Secondary backup site. Each DS-0 on VP4 carries a separate asynchronous polling data stream.

LOOP AM3440	LOOP AM3440-C === System Setup (MAP) === 16:49:13 12/01/2010														
ARROW KEYS:	CURSOF	R MOV	νE, '	TAB	ROLL	OP	TIONS								
MAP NO: MAF	° 1														
	_ Target	Ĵ	8BI	DRA					Source	Э	FOM	CAS			
Target	PO/TS	D SI	L/PO	ΤS	PO/TS	D	SL/PO	TS	PO/TS	D	SL/PO TS	PO/TS	D	SL/PO T	S
Slot : 3		====		===		==	======	===	=====	==	=======	=====	==		=
Port : VP4	<u>4 1</u>	d i	13	1	17	d			1	d		17	d		
T.S. : 01	<u>4</u> 2	d :	13	2	18	d			2	d		18	d		
	3	d			19	d			3	d		19	d		
	4	d			20	d			4	d		20	d		
T.S.# : 1	5	d			21	d			5	d		21	d		
Clear : No	6	d			22	d			6	d		22	d		
d/v :d	7	d			23	d			7	d		23	d		
	8	d			24	d			8	d		24	d		
	9	d			25	d			9	d		25	d		
Source	10	d			26	d			10	d		26	d		
Slot : A	11	d			27	d			11	d		27	d		
Port : P1	12	d			28	d			12	d		28	d		
T.S. : 01	13	d			29	d			13	d		29	d		
	14	d			30	d			14	d		30	d		
Confirm?Yes	15	d			31	d			15	d		31	d		
	16	d			32	d			16	s					

<< Press ESC to return to Controller Setup menu, then Press D to active >> $\,$

Set up the backup mode in the Secondary backup site 8DBRA card.

SLOT 4 8DBRA P1 ARROW KEYS: CURSOR MOVE, TA	=== Backup Setup === B: ROLL OPTIONS	17:09:12 12/01/2010
<u>Backup Type : Dual Host</u>		
Site : Secondary		

It is not necessary to map any ports at the Secondary backup site.

SLOT 4 8DBRA P1		=== Por	rt Map S	Setup ===	17:10:57	12/01/2010
<u>This is Secondary</u>	site of	Dual Host	t, don't	t need set map!		
[Display] Port TS: 1 VP4 MAP: 12345678	9	17	25	32		



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At the Secondary backup site, map the incoming T1 DS-0 time slots to the 8DBRA Virtual Port 4. VP4 is the only port you can chose when mapping to a card set to be the Dual Host Secondary.

LOOP	AM	3440-	-C					===	= Syste	∋m	Setup	(MZ	AP) ===		1	7:1	4:15	12	/0	1/202	10
Pleas	se	Input	t dea	cin	nal	. nu	ımbe	er	(1~32)	, E	BACKSPA	ACE	to edit	t							
MAP N	10:	MAP_	_1																		
			Tar	get	-		8BI	DRA					Source	e							
Targe	et		PO/1	ΓS	D	SL/	'PO	ΤS	PO/TS	D	SL/PO	TS	PO/TS	D	SL/PO	ΤS	PO/1	ΓS	D :	SL/PO) TS
Slot	:	4	====	==	==					==			=====	==		===	====	==	===		
Port	:	VP4	4	1	d	1	4	1	17	d											
T.S.	:	01	4	2	d	1	4	2	18	d											
				3	d				19	d											
				4	d				20	d											
T.S.#	:	1		5	d				21	d											
Clear	: :	No		6	d				22	d											
d/v	:	d		7	d				23	d											
				8	d				24	d											
				9	d				25	d											
Sourc	ce		-	10	d				26	d											
Slot	:	А	-	11	d				27	d											
Port	:		-	12	d				28	d											
T.S.	:	01	-	13	d				29	d											
				14	d				30	d											
Confi	rm	?Yes		15	d				31	d											
				16	d				32	d											



1+1 Card Backup



SCADA Primary & backup hosts using a 1+1 Card Backup (2 8DBRA cards)

Backup cards are in adjacent slots, such as 1 & 2, 3 & 4, 5 & 6, 7 & 8, 9 & 10. The odd numbered slot is primary, the even numbered slot is the backup.

First set the back up mode in both cards.

<u>SLOT 3 8DBRA P1</u> ARROW KEYS: CURSOR MOVE, TAB	=== Backup Setup === : ROLL OPTIONS	17:31:56 12/01/2010
Packup Time , 1+1 Card Pack	12	
Backup Type : 1+1 Cald Back		
Mode : revertible		
Force Switch: NO		
Status : Working		
<u>SLOT 4 8DBRA P1</u> ARROW KEYS: CURSOR MOVE, TAB	=== Backup Setup === : ROLL OPTIONS	17:32:50 12/01/2010
Backup Type : 1+1 Card Back	up	
Mode : revertible		
Force Switch: NO		
<u>Status : Stand-By</u>		



Now map the odd numbered card. The map is automatically propagated to the second card.

SLOT 3 8DBRA P1 ARROW KEYS: CURSOR MOVE,	=== Port Map Setup === , TAB: ROLL OPTIONS	17:47:32 12/01/2010
[Setup]		
Virtual Port: P1		
TS start : 03		
Total TS : 01		
RS232 Port : 1		
Command : Set		
[Display]		
Port TS: 1 9	17 25 32	
VP1 MAP: 11 iiiiii iiiii	iii iiiiiiii iiiiiiii	
VP2 MAP: 22 iiiiii iiiii	iii iiiiiiii iiiiiiii	
VP3 MAP: iiiiiiii iiiii	iii iiiiiiii iiiiiiii	

Map the Virtual Ports to the DS-0 time slots as described previously in this document. Now the same port number in either card can be connect to a polling host. Polls from either host are broadcast out to the remote drop locations. All poll responses from remote locations come out the same RS232 port number to the polling host on both cards.



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8DBRA card used as an 8 port asynchronous card

Set the card for "Backup Type: NO"

SLOT 3 8DBRA P1=== Backup Setup ===18:14:18 12/01/2010ARROW KEYS: CURSOR MOVE, TAB: ROLL OPTIONS

<u>Backup Type : NO</u>

Map port 1 through 8 to VP1 using the "K - > Port Map Setup".

SLOT 3 8DBRA P1 ARROW KEYS: CURSOF	=== Port Map Set MOVE, TAB: ROLL OPTIONS	ıp === 18:15:56	12/01/2010
[Setup] Virtual Port: P1			
TS start : 01 Total TS : 01 RS232 Port : 1			
Command : Set			
[Display]			
Port TS: 1	9 17 25 32		
VP1 MAP: 12345678	iiiiiiii iiiiiiii iiiiiiii		
VP2 MAP: iiiiiiii	iiiiiiii iiiiiiii iiiiiiii		
VP3 MAP: iiiiiiii	iiiiiiii iiiiiiii iiiiiiii		
VP4 MAP: iiiiiiii	iiiiiiii iiiiiiii iiiiiiii		

Map the VP1 time slots 1 through 8 to whatever DS-0 time slots required.

LOOP Pleas	AM se	3440- Input	-C t_de	cir	nal	_ nu	umbe	=== er	= Syste (1~24),	∋m , E	Setup (M BACKSPACE	IAP) to	=== edi	t		18	3:17	7:05 12	2/()1/201	10
MAP N	10:	MAP_	- <u></u>									_				_					
Target 8BD							DRA	RA				Source			Quad-T1 CAS						
Targe	et		PO/	ΤS	D	SL/	'PO	ΤS	PO/TS	D	SL/PO TS	S PC	/TS	D	SL/	'PO	ΤS	PO/TS	D	SL/PC) TS
Slot	:	3	===	==	==			===	=====	==	-=======	: ==	===	==			===		==		
Port	:	VP1	1	1	d	1	1	1	17	d		1	1	d	3	1	1	17	d		
T.S.	:	80	1	2	d	1	1	2	18	d		1	2	d	3	1	2	18	d		
			1	3	d	1	1	3	19	d		1	3	d	3	1	3	19	d		
			1	4	d	1	1	4	20	d		1	4	d	3	1	4	20	d		
T.S.#	:	01	1	5	d	1	1	5	21	d		1	5	d	3	1	5	21	d		
Clear	:	No	1	6	d	1	1	6	22	d		1	6	d	3	1	6	22	d		
d/v	:	d	1	7	d	1	1	7	23	d		1	7	d	3	1	7	23	d		
			1	8	d	1	1	8	24	d		1	8	d	3	1	8	24	d		
				9	d				25	d			9	d							
Sourc	e			10	d				26	d			10	d							
Slot	:	1		11	d				27	d			11	d							
Port	:	P1		12	d				28	d			12	d							
T.S.	:	08		13	d				29	d			13	d							



Asynchronous Data Over Synchronous Links Using Oversampling

Any synchronous bit stream RS232 interface can transport asynchronous data that is 1/3 or less the synchronous data rate. For example, 2400 async data can be sent over a 9600 bps synchronous link. Data running async 9600 can be sent over a synchronous 56 or 64 kbps link. Data at 19200 bps is right at the borderline with 56 kbps links, but will typically work reliably. Likewise, 38,400 bps async data can be sent over a synchronous link of 192 kbps or 256 kbs. While 1/3 may be sufficient, it is preferable to have a synchronous sample rate that is at least 4 times faster than the asynchronous data rate.

The key is that the synchronous channel is fast enough so the bit width of the async data is the 1/3 or less the sync bit width. The async bit width can be distorted and shift back and forth (jitter) as long as the sync sampling is fast enough.

Async UARTS will sample async data at a rate 16 times the async bits per second rate. A UART sets or resets its sampling starting point whenever there is a data transition between a one to a zero (mark to space). The async UART then counts over 8 sample times to the middle of the data bit transition data, where each count, or sample, is 1/16th of the async bit time. At the 8th sample, the UART makes the decision if the bit is a one or is a zero.

With asynchronous characters, typically 8 data bits plus a start bit and a stop bit, the UART is guaranteed that there is a zero at least every 10 bits, since every start bit of a character is a start/space/zero bit that follows a stop/mark/one bit.

How over sampling works is illustrated below with underscore and dash, where the underscore represents a one, the dash a zero. The sync sample is a "+", the async sample is "|":

The above shows that both the sync data channel and the async UART use sampling. The sync channel sampling of the async data mimics the function of the standard async UART, but with a lower sample rate. While the sample rate is lower, the async one and zero data bits are sampled fast enough to allow the sync channel to replicate the data over the communications link.