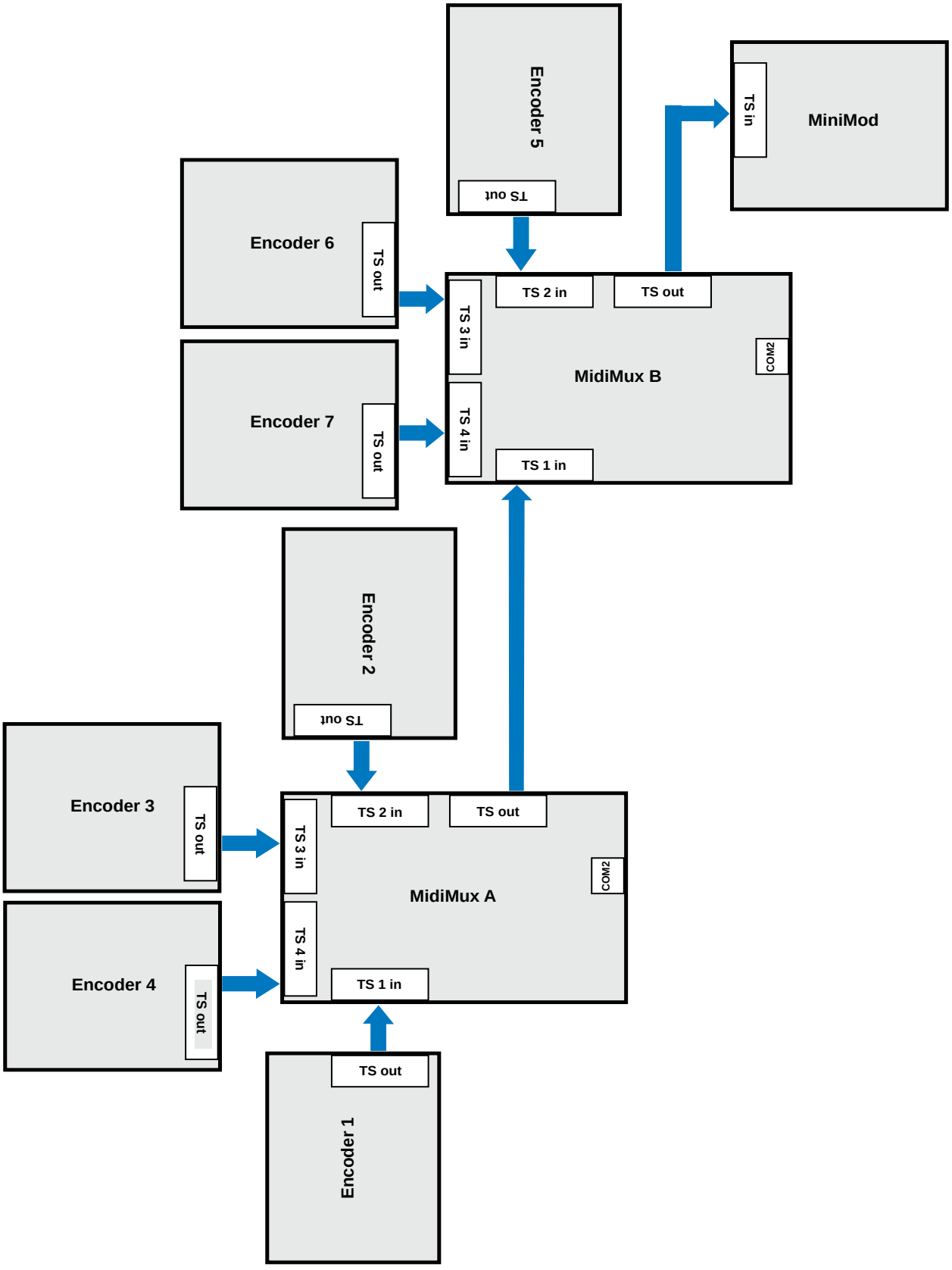
Chaining Multiplexers

Application note

The MidiMux can control and multiplex up to four MPEG encoders. If you need to encode more than four services on one transport stream, you need to chain multiple multiplexers.

See the following diagrams for examples on how multiplexers can be chained:



How to Connect the Multiplexers

When chaining multiplexers, the TS output port of one multiplexer must be connected to the TS input of the next multiplexer. As all input ports on MiniMux and MidiMux are equal, it does not matter which TS input port you use for chaining The TS output of the last multiplexer in the chain should be connected to your output device (modulator, IP streamer, ASI output or similar).

You should use a Type 2 cable (see http://www.maintech.de/fileadmin/Datasheets/Cable-Guide_v1_en-1.pdf for information about cable types) to connect two multiplexers. However, Type 1 cables will also work, but you need to make sure that the power supply jumper on the TS output of the first multiplexer is **not** set.

The transport stream clock should go with the data – so TS input port and TS output port should be configured as follows for chaining:

- TS Output – Clock Direction: generate
- TS Output – Framesize: 188 Byte
- TS Output – Clockrate: *see below*
- TS Input Mode: external clk

The transport stream clock rate should be the sum of all TS sources connected to the multiplexer plus a safety margin of approximately 10%. Let's assume you have a MidiMux with four connected encoders, each set to a data rate of 4000 kBit/s. This gives you a total data rate of 16000 kBit/s for this MidiMux's TS output. With the safety margin, you should set the TS Output Clockrate to 18000 kBit/s. The next MidiMux in the chain receives this stream at one of its TS inputs and adds another three services from encoders connected to the other three TS inputs – again each with 4000 kBit/s. This gives us 7 times 4000 kBit/s at the output of this MidiMux. With the safety margin, we set the TS output to 32000 kBit/s.

If you experience distorted video or audio streams or if you see errors in the transport stream, this might be a clue that the output data rates of your multiplexers are too low. You should then try to increase the output data rates or decrease the encoder bitrates.

If you want to know more about the bitrate settings, please read our application note "About Bitrates" (see http://www.maintech.de/fileadmin/Datasheets/Bitrates.pdf).

PID Allocation

The PID allocation in a complex system involving multiple multiplexers must be carefully planned. For each service, you need to assign Audio, Video and PMT PIDs. The PID number range is from 0x0000 to 0x1FFF. PIDs below 0x20 are reserved for PSI tables and PID 0x1FFF is reserved for stuffing data. We also suggest reserving PIDs 0x1FF0 to 0x1FFE for special purposes.

You need to assign unique PIDs for Audio, Video and PMTs for all encoders. We suggest the following scheme:

	Video PID	Audio PID	PMT PID	Service ID
1st encoder	0x0100	0x0101	0x0102	1
2nd encoder	0x0200	0x0201	0x0202	2
3rd encoder	0x0300	0x0301	0x0302	3
...	...	...	...	...

As our MPEG encoders embed the PCR information into the video stream (or the audio stream for radio services), the PCR PID is not a separate PID, but must be set to the video PID for video services or the audio PID for radio services.

If you have one or more Teletext inserter boards in the system, you need a TTX PID for those services. We suggest using the PID following the audio PID for this service as TTX PID.

So let's assume a more complex example with seven encoders where encoder #2 encodes a radio service and encoder #4 has a Teletext inserter:

	Video PID	Audio PID	PMT PID	TTX PID	PCR PID	Service ID
1st encoder	0x0100	0x0101	0x0102		0x0100	1
2nd enc. (Radio)	0x0200 (not used)	0x0201	0x0202		0x0201 (!)	2
3rd enc.	0x0300	0x0301	0x0302		0x0300	3
4th enc. (TTX)	0x0400	0x0401	0x0402	0x0403	0x0400	4
5th enc.	0x0500	0x0501	0x0502		0x0500	5
6th enc.	0x0600	0x0601	0x0602		0x0600	6
7th enc.	0x0700	0x0701	0x0702		0x0700	7

To make the system work properly, you need to set up those PIDs in the encoder settings for all encoders and in the maintech Mux Configurator for PSI table generation (see below).

Configuring the encoders

Connect to your multiplexers via serial port. As a first step, set up the input port modes according to the boards connected to the input ports. For our example this means:

Mux A:

- TS 1 Input Mode: MPEG encoder
- TS 2 Input Mode: MPEG encoder
- TS 3 Input Mode: MPEG encoder
- TS 4 Input Mode: TTX

Mux B:

- TS 1 Input Mode: external clock
- TS 2 Input Mode: MPEG encoder
- TS 3 Input Mode: MPEG encoder
- TS 4 Input Mode: MPEG encoder

As a second step, visit each encoder settings menu and set up the PIDs that you have allocated for the encoder in the last section.

As an example, the settings for the Encoder 1 on Mux A should look like this:

- Program Video PID: 0x100
- Program Audio PID: 0x101
- Program PMT PID: 0x102
- Program ID: 1

Respectively, the settings for Encoder 2 on Mux B should look like this:

- Program Video PID: 0x500
- Program Audio PID: 0x501
- Program PMT PID: 0x502
- Program ID: 5

PSI Table Generation

The PSI tables (PAT, SDT, NIT and PMTs) must be generated by the last multiplexer in the chain – this multiplexer is called the table generating multiplexer. All other multiplexers must have their table generator switched off (PSI Settings ⇨ PSI Table Generator: disabled).

The table generating multiplexer will generate the tables for the encoders that are connected to the multiplexer itself according to the settings in the encoder menus. For the encoders that are connected to the other multiplexers in the chain, extra service descriptions must be generated and programmed into the table generating multiplexer.

Programming the table generating multiplexer with extra service descriptions:

1. Install and run the DVB Mux Configurator.
2. In the tab “Stream Configuration”, enter the generic settings for your transport stream.
3. A PID filter is not required in this configuration. In the tab “PID Filter”, please make sure that the list with PID filter rules is empty and the default action is set to “Pass”.
4. In the tab “PSI Generator”, add a service for each encoder that is not connected directly to the table generating multiplexer. Make sure that video & audio PIDs as well as the service IDs match the settings for the encoders.
5. Save the configuration file so that you have a starting point when you need to change the settings later.
6. In the file menu, select “Export to Mux…” to compile the binary file that contains the required instructions for the multiplexer.

7. Connect to your table generating multiplexer by using HyperTerminal and set the PSI table generator to “extended”.
8. On the multiplexer, select “upload PSI tables”; then send the binary file you exported in Step 6 via XModem.
9. The multiplexer will now generate PSI tables for the encoders that are connected directly and for the additional services you added in the maintech Mux Configurator.

Errata/corrections:
10.02.2010 v1.0 en

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