

Star-Hub Synchronization option

- **Compatible with all UF2 and UF2e boards**
- **Zero clock delay between channels**
- **Supports up to 16 boards in one system**
- **Multiple systems synchronization**
- **Clock and trigger synchronization**
- **Piggyback module for UF2e boards**
- **All cables included**
- **Easy-to-program software interface**
- **Low cost - only one option per card group required (not every board)**
- **Can be added as a later upgrade**



General Information

The Star-Hub modules allow the synchronization of up to 16 UF2e boards in one system or even the synchronization of multiple systems each equipped with several boards. The synchronization option was designed for system setup with no phase delay between channels.

The connection of the boards is automatically re-recognized and checked by the driver at load time. The Star Hub programming is included in the standard board interface and consists of only a few additional commands.

Synchronization in one system

Two versions of the Star-Hub are available: a 5 card version (Star-Hub 5) and a 16 card version (Star-Hub 16). The 5 card version as shown in the photograph doesn't need an additional system slot while the 16 card version occupies the adjacent system slot.

It is possible to synchronise boards of the same type with each other as well as different types to create mixed-mode systems.

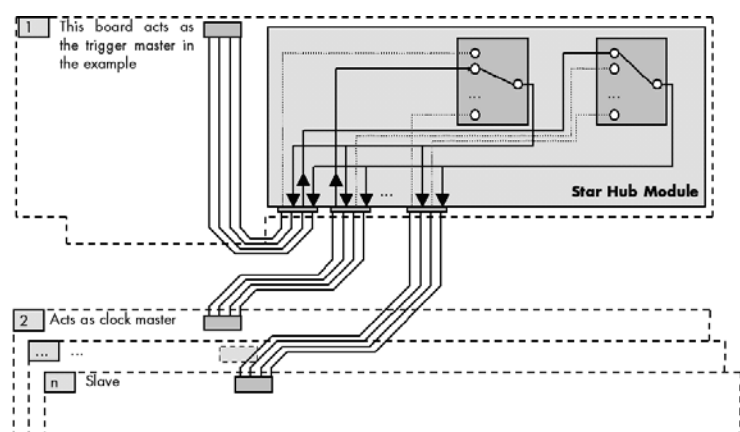
The module acts as a Star-Hub for the clock and trigger signals. These are distributed to each board, including the Master, by a small cable of the same length. The user can programme any board inside this system as the Clock Master. All clock sources of this board can be used, be it internal clock, reference clock or external clock.

Any one or even several boards can be used as trigger sources for the complete system. The trigger source of all boards can be combined with logical OR or logical AND. All trigger modes that are available on the master boards are also available if the Star-Hub is used.

Synchronised cards do not need to run with the same sampling rate. Indeed it is possible to run any of the cards with a divided sampling clock that is still synchronised with the fastest clock. This allows the possibility to synchronise even cards of different speed grades without slowing down the fast cards.

Hardware block diagram of single

Star-Hub



System synchronization

Now it is even possible to synchronise several systems with each other having the same advantages that the standard Star-Hub gives. This is a unique feature to the UltraFast boards. This can be useful if:

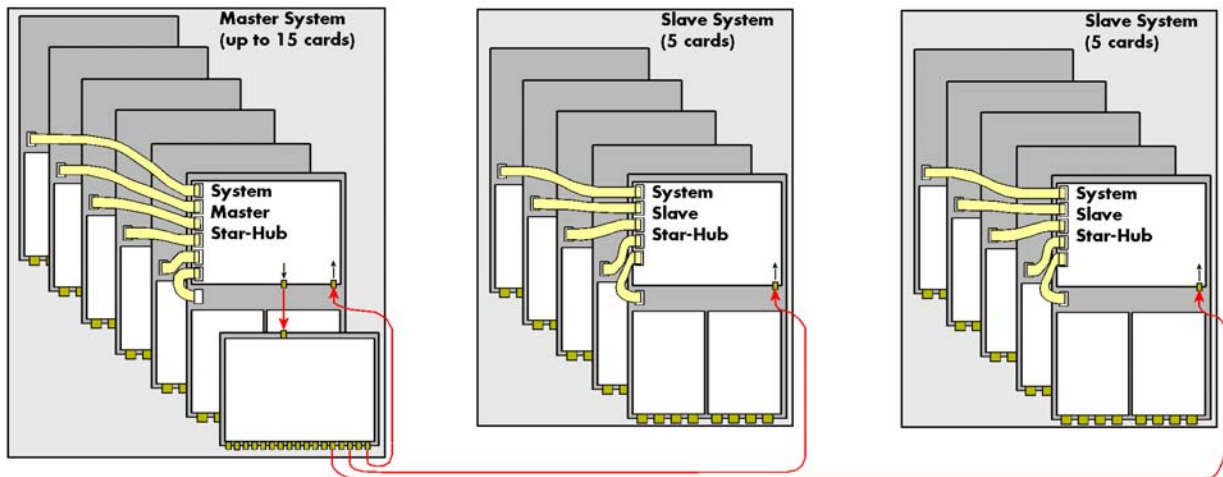
- The number of channels that fit into one system should be exceeded
- Data should be streamed between the boards and the host PC. Due to the limits of the PCI Express or 66 MHz /33 MHz PCI bus bandwidth in a single PC, it can be useful to use multiple PC's and therefore increase the system bandwidth from multiple PCI buses.
- Extensive online calculations have to be made for several channels and a single CPU processing performance isn't sufficient

This system synchronization can be done using special System Star-Hubs. Each system is then equipped with one System Star-Hub that is connected with a Master System Star-Hub. In this setup the master system generates clock and trigger as described before. All slave systems only receive clock and trigger information and can't be used as clock or trigger sources.

The complete system can be extended step by step by adding new systems with a Slave System Star-Hub or by adding new cards to one system. This extension can be continued until the maximum number of supported cards is reached.

However it is still possible in this configuration to use the slave systems as independent synchronised systems allowing again all possibilities of the standard one system Star-Hub.

System Synchronization block diagram



The master system generates trigger and clock information for all systems. Trigger and clock signals are routed to the slave systems as well as to the master itself using shielded coax cables. The system-connection lines have equal length. Within each system a System Star-Hub distributes the signals to each connected card. These cables again have all the same length.

Technical Details

	Star-Hub 5	Star-Hub 16	System Star-Hub Master	System Star-Hub Slave 5	System Star-Hub Slave 16
Max sync cards in system	5	16	15	5	16
Max synchronized systems	n.a.	n.a.	17 (including master)	n.a.	n.a.
Additional space needed	-	1 slot (space only)	1 additional PCI slot needed	1 slot (bracket and space only)	1 slot (bracket and space only)
internal sync cables included	5	16	15	5	16
system sync cables included	-	-	-	1 set (2 cables) of 2m	1 set (2 cables) of 2m
Clock master	Any card in system	Any card in system	Any card in system	System Star-Hub Master clock	System Star-Hub Master clock
Divided clock on cards	possible	possible	possible	n.a.	n.a.
Trigger master	Any card in system	Any card in system	Any card in system	System Star-Hub Master trigger	System Star-Hub Master trigger
Trigger OR/AND conjunction	possible	possible	possible	n.a.	n.a.
Differing memory setup	possible	possible	possible	n.a.	n.a.
Minimum sampling rate	no additional limits	no additional limits	no additional limits	limits to minimum external clock	limits to minimum external clock

Maximum number of channels in example configurations

	Card type in example	Sampling rate per channel	Star-Hub 5	Star-Hub 16	Multiple Systems Slave Star-Hub 5	Multiple Systems Slave Star-Hub 16
Max number of cards in total			5 cards	16 cards	95 cards	271 cards
8 bit A/D channels	UF2e.2031	100 MS/s	20 channels	64 channels	380 channels	1084 channels
Medium fast 12 bit A/D channels	UF2e.3122	10 MS/s	40 channels	128 channels	760 channels	2168 channels
Fast 12 bit A/D channels	UF2e.3027	100 MS/s	10 channels	32 channels	190 channels	542 channels
16 bit A/D (SE or fully differential)	UF2e.4652	3 MS/s	40 channels	128 channels	760 channels	2168 channels
Slow 16 bit A/D channels (SE)	UF2e.4731	500 kS/s	80 channels	256 channels	1520 channels	4336 channels
Fast digital I/O channels	UF2e.7020	125 MS/s	160 channels	512 channels	3040 channels	8672 channels
Fast D/A channels	M2i.6111	125 MS/s	20 channels	64 channels	380 channels	1084 channels

Order Information

Options

Order no.	Option
UF2e.xxxx-SH5 (1)	Synchronization Star-Hub for up to 5 cards in one system, only 1 slot width, all sync cables included
UF2e.xxxx-SH16 (1)	Synchronization Star-Hub for up to 16 cards in one system, all sync cables included
UF2e.xxxx-SSHM (1)	System-Star-Hub Master for up to 15 cards in the system and up to 17 systems, sync cables included
UF2e.xxxx-SSHS5 (1)	System-Star-Hub Slave for up to 5 cards in one system, all sync cables included
UF2e.xxxx-SSHS16 (1)	System-Star-Hub Slave for up to 16 cards in one system, all sync cables included

(1) : Only one of the options can be installed on a card at a time.

Warranty and Software Maintenance

All UltraFast boards are supplied with a two-year hardware warranty and include life-time technical support and free software updates, including SDK's for future Microsoft Windows and Linux versions.



