# Fast Ethernet Hub

## Instruction Leaflet

5 port hub **RS stock no. 288-5825**

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1.0 Introduction

1.1 Inspecting the package and product

Inspect the contents of this package for any signs of damage and ensure that the items listed below are included.

This package should contain:
1 x Fast ethernet hub
1 x AC Power Cord
2 x Mounting brackets for optional mounting
2 x Mounting screws for use with the brackets
1 x Installation and user guide

1.2 Product Description

The RS Fast Ethernet Hub is an easy to install, cost-effective 100BASE-TX hub that also has a switched port that can be configured to provide "bridged" connectivity between a 100Mbps segment and a 10Mbps segment or between two 100Mbps segments. It is a complete "plug and play" operational unit enclosed in a lightweight, compact, rugged metal enclosure suitable for office or lab locations. Each unit has its own internal power supply. The Hub is easily installed as an addition to an existing 10 or 100Mbps network segment and is suitable for horizontal or vertical mounting. The Hub is ideally suited for adding a Fast Ethernet workgroup to an existing 10Mbps or 100Mbps network. A small 100Mbps workgroup connects to the five ports while another workgroup or existing network segment - a separate collision domain of 10Mbps or 100Mbps units - connects to port 6. For expansion of the five 100Mbps ports, an additional 100Mbps hub can be cascaded from port 1. Each domain can have its own local servers and other local traffic. Thus, the Hub can bridge-isolate one collision domain from the other - separating the local traffic between each workgroup's users and server from the rest of the network. The Hub will filter and forward the packets to/from port 6 and the other ports, thereby giving more bandwidth to each domain for maximum network performance.

The Hub chassis houses one main board for the five hub ports plus a daughter board for the switched port. It has an internal power supply and a small cooling fan in the bottom. The front of the chassis consists of five shared 100Mbps RJ-45 ports and one 100Mbps or 10Mbps switched RJ-45 port. There is an up-link (UP-LINK) switch for Port 1. The hub has power (PWR) and collision (COL) LED's for the unit, and link (LINK) and receive (RX) activity LEDs for each of the five shared ports and for Port 6. Rubber feet on the bottom provide a sturdy grip and clearance for the exhaust of the cooling fan. The internal power supply is auto-ranging AC power input of 115-230 Vac, 50/60 Hz. The recessed male IEC power connector is located at the rear-right. Two mounting brackets for optional wall mounting are supplied with each unit.
Agency Approvals
UL Listed (UL 1950), cUL, CE
Emissions: meets FCC part 15, class A

Warranty
Three years, return to factory

5.2 Ordering Information
Magnum 600ES Personal Hub Plus

Federal Communications Commission

Radio Frequency Interference Statement
This equipment generates, uses and can radiate frequency energy and if not installed and used properly, that is in strict accordance with the manufacturer’s instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Important: RS Fast Ethernet Hubs contain no user serviceable parts. Attempted service by unauthorised personnel shall render any and all warranties null and void. If problems are experienced with the RS fast ethernet hubs, consult the troubleshooting section of this manual.

1.2.1 Ports 1-5 100Mbps shared ports

Ports 1-5 are shared 100BASE-TX ports. Each port has its own link and RX (receive) activity LED built into the RJ-45 connector. The link LED will be on when proper cable connection is made on both ends, and the RX LED will flash to indicate activity when the port is receiving data. The up-link switch for port 1 is located on the left side and enables port 1 to either connect to a user station or to another hub. See section 3.4 for more details about up-link.

1.2.3 Port 6: switched 10 or 100Mbps port

Port 6 is located on the right front panel. It may be user-selected to operate either as a 10BASE-T port or as a 100BASE-TX port using the “10 - 100” manual switch. The switched port offers great flexibility in connecting the unit - as an additional 100Mbps segment - to an existing 10 or 100Mbps network. Because this port is segmented from the other ports, it provides a separate collision domain.

1.3 Features and benefits
- Adds 100Mbps ports as a collision domain to a 10 or 100Mbps segment
Five 100Mbps ports can be added to either a 10Mbps Ethernet or 100Mbps Fast Ethernet segment as a new collision domain, so that configurability and performance of both the new and the existing segments are maximised.
1. Manual speed selection of 10Mbps or 100Mbps on Port 6
   Port 6 can be set by the user as either a 10BASE-T or 100BASE-TX port using the manual “10 - 100” switch on the front panel.

2. “Plug and Play” installation and operation
   The Fast Ethernet Hub learns the network addresses of both network segments from the packets in the traffic, so there is no software set-up required. As nodes are added or changed, the unit learns the new network addresses and adapts its filtering and forwarding of packets automatically.

3. Segments 100Mbps networks for high performance and simplified expansion
   The Hub provides a separate collision domain which maximises available bandwidth for both of the attached segments, enhancing network performance. The segmentation of the port 6 switch also resets cable distance limitations and repeater hop counts to enable easy expansion of 100Mbps networks.

4. Portable design makes network analysis easy
   The compact design of the Hub makes it portable, allowing LAN managers to experiment with extending 100Mbps segments where cable distances and repeater hop counts might be limiting. The Hub, with port 6 operating as a bridge device, resets distance limitations when it is inserted into a network.

5. Operation is transparent to software
   The RS Fast Ethernet Hub operates as a hardware switch. Its operation will not affect any standard software applications or SNMP network management platforms.

6. Compact enclosure allows for versatile installation
   The compact physical size of the unit allows it to be installed in office or lab locations. Two mounting brackets are included for optional vertical mounting. The rugged metal enclosure provides durability, and the internal universal power supply enables one model to be usable worldwide.

1.4 Applications
   The RS Fast Ethernet Hub is designed to provide connectivity between a 100Mbps (Fast Ethernet) workgroup segment to a 10Mbps (Ethernet) or 100Mbps (Fast Ethernet) segment. It is simple to install and use, making shared Fast Ethernet networks practical for connecting high performance user groups in a variety of ways. Since 10/100 NICs are widely available at low cost, 100BASE-TX Fast Ethernet has become desirable for many performance-oriented users. The Hub allows new 100Mbps network segments to be interoperable with existing 10Mbps networks, and be a separate collision domain in order to maximise performance of both segments. For this example, Port 6 may be configured as a 10BASE-T port while Ports 1-5 are a new separate collision domain of shared 100BASE-TX ports.

Five 100Mbps nodes can be added to an existing 10Mb/s network

![Figure 3](image-url)

**Packet processing on switched port, port 6**
- **Processing type**: Store and forward
- **Filtering and forwarding rate**: Switch = “10”, 14,880 pps max.  
  Switch = “100”, 148,800 pps max.
- **Auto-learning**: 1024 addresses per port
- **Packet buffers**: 256KB, dynamically allocated and shared on both ports
- **Latency** (not including packet time): 100 to 100Mb: 1µs 10 to 100Mb: 4µs
- **CPU Type**: State machine
  - 100 to 10Mb: 4µs

**Maximum ethernet segment lengths**
- 10BASE-T (unshielded twisted pair, 10Mb) - 100m (328 ft)
- 100BASE-TX (Cat. 5 twisted pair, 100Mb) - 100m (328 ft)

**Network standards**
- Ethernet IEEE 802.3u: 100BASE-TX
- IEEE 802.3: 10BASE-T

**Operating environment**
- Ambient temperature: 32°F to 120°F (0°C to 50°C)
- Storage temperature: -20°C to 60°C
- Ambient relative humidity: 10% to 95% (non-condensing)

**Power supply (internal)**
- AC Power connector: IEC-type, recessed, rear of chassis
- Power input voltage: 100 to 240 Vac (auto-ranging)
- Power input frequency: 47-63 Hz
- Power consumption: 30 watts max.

**Mechanical switches**
- Port 1 only: UP-LINK: MDI-X thumb-operated slide switch, converts RJ-45 port from a regular (= position) user segment port to a crossover (X position) up-link port for On/Off connection to a central hub or a cascaded hub.
- Port 6 only: Thumb-operated slide switch, sets speed for the RJ-45 port to 10Mbps (“10” position) or 100Mbps (“100” position). For proper switching operation, note that the hub must be powered down and up to reset the internal switch buffers when the position of this switch is changed.

**Packaging**
- **Enclosure**: High strength sheet metal.
- Suitable for wiring closet shelf, wall or desktop mounting.
- **Dimensions**: 9.1 in. D x 6.1 in. W x 1.3 in H (23.0cm x15.5 cm x 3.3 cm)
- **Weight**: 1.55lb. (0.7kg)
- **Cooling method**: Fan cooled, internal @ 7cfm

**LED Indicators on Chassis**
- **PWR**: Steady On when power applied
- **COL**: Collision, flashing when collision occurs on ports 1-5
- **LINK (per port)**: Steady On when twisted-pair link is operational
- **RX (per port)**: Activity, flashing when port is receiving data
4.1 Before calling for assistance
1. If difficulty is encountered when installing or operating the Hub, refer back to Section 2.0 installation and section 3.0 operation. Check to make sure that the various components of the network are functioning.
2. Check the cables and connectors to ensure that they have been properly connected and the cables/wires have not been crimped or in some way impaired during installation.
3. Be certain that the AC power cord is plugged into a functioning electrical outlet. Make sure that the AC power cord is properly plugged into the unit. Use the PWR LED to verify that the unit is receiving proper power.
4. If the problem is isolated to a network device other than the Hub, it is recommended that the problem device be replaced with a known good device. Verify whether or not the problem is corrected. If not go to step 5 below. If the problem is corrected, the Hub and its associated cables are functioning properly.
5. If the problem continues after completing step 3 above, contact the RS Technical Helpline on Tel: 01536 402888.

4.2 When calling for assistance
Please be prepared to provide the following information.
1. A complete description of the problem, including the following points:
   a. The nature and duration of the problem
   b. Situations when the problem occurs
   c. The components involved in the problem
   d. Any particular application that, when used, appears to create the problem.
2. An accurate list of product model(s) involved, with serial number(s).
3. It is useful to include other network equipment models and related hardware, including personal computers, workstation, terminals and printers, plus the various network media types being used.
4. A record of changes that have been made to your network configuration prior to the occurrence of the problem. Any change to system administration procedures should all be noted in this record.

5.0 Technical specifications

Performance
Port 1-5:
   Data rate: 100Mbps
   PDV (Path Delay Value): 60BT
PORT 6:
   Switch selectable, 10 or 100Mb/s
   When set to “100”:
      Data rate: 100Mb/s
      PDV (Path Delay Value): 50BT (end node)
   When set to “10”:
      Date Rate: 10Mbps

Figure 4 below shows how another 100Mbps workgroup can be added using a 100Mbps hub. By placing the RS Fast Ethernet Hub in the middle, it acts as a bridge separating the 10Mbps and the 100Mbps traffic domains.

An expanded 100Mbps workgroup connects to existing 10Mb network

Figure 5

The previous two examples show that the Hub not only provides connectivity between a 100Mbps workgroup and a 10Mbps workgroup, but it also segments the local traffic of the new and the existing segments from each other. This type of configuration is ideal for adding a new 100Mbps workgroup without slowing down the existing 10Mbps network with all the unwanted local packets from the new workgroup.

Consider yet another situation in figure 5 where a new 100Mbps user group is to be added to an existing 100Mbps network.

The Hub not only provides more 100Mbps ports to the network, it also adds a collision domain giving configuration flexibility to the new user group. The existing network can grow without having to worry about cable distance limitations and repeater hop counts associated with the new segment.

Joining two 100Mbps workgroups

Figure 6

The above figure shows two 100BASE-TX segments connected via the Hub. All the packet forwarding and filtering done by the Hub is transparent to the users, who only see one network in terms of node addresses. Performance of the network is enhanced as the available bandwidth on each segment will not be affected by the local traffic on the other segment. Since the Hub segments the network, the bandwidth available for each collision domain is maximized.
2.0 Installation

This chapter provides instructions for installing the RS Fast Ethernet Hub.

2.1 Locating the Hub

The location of the Hub is dependent on the physical layout of the network and the workgroups to be bridge-isolated. The compact size of the unit allows it to be tabletop, shelf or wall-mounted. Brackets for vertical mounting are included. The cooling fan in the bottom of the unit exhausts air underneath the unit, so the space around the rubber feet should be kept clear.

Locate an AC socket that is within six feet (2 meters) of the intended position. The rugged metal case of the Hub will normally protect it from accidental damage in a lab or workplace setting. Keep an open area around the unit so that cooling can occur while the unit is in operation.

Each Hub is shipped with two mounting brackets (and screws), to allow the unit to be mounted in nearly any desired orientation or position. The brackets are attached to the case with one of the metal screws for each bracket. It is recommended that the brackets be attached to two opposite corners on the unit. When properly attached, the brackets will extend slightly below the base of the unit to allow clearance for the rubber feet.

2.2 Ethernet media connection

The Hub may be used as a bridge serving the needs of a small 100Mbps workgroup that connects to a large network environment (either 10 or 100Mb). In either case, 100Mbps connectivity is achieved using Category 5 twisted pair wiring.

2.3 Collision domain diameter

The collision domain diameter is the length of the longest path between any two devices in a single collision domain. A collision domain is defined as a cluster of network devices which are connected by means of a repeater or repeaters such that no bridging devices are present between any two devices in the cluster. In order to install an IEEE 802.3u compliant Fast Ethernet network, the collision domain, regardless of the actual network topology, must be less than 512BT (Bit Times). Bit Times are related to media type as shown in Table 2.a.

Table 2a: Worst case round-trip delay for Fast Ethernet media*

<table>
<thead>
<tr>
<th>Media type</th>
<th>Round-trip delay in Bit time per meter (BT/m)</th>
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</thead>
<tbody>
<tr>
<td>Fibre optic</td>
<td>1.000</td>
</tr>
<tr>
<td>Shielded TP cable</td>
<td>1.112</td>
</tr>
<tr>
<td>Category 5 cable</td>
<td>1.112</td>
</tr>
<tr>
<td>Category 4 cable</td>
<td>1.140</td>
</tr>
<tr>
<td>Category 3 cable</td>
<td>1.140</td>
</tr>
</tbody>
</table>

* Worst case delays taken from IEEE Std 802.3u-1995, actual delays may be less for a particular cable. Contact your cable supplier for exact cable specifications.

Each Fast Ethernet device component also has an associated BT delay, which depends on the physical signaling system employed. Table 2b shows each Fast Ethernet device component and the associated BT delay.

3.1.4 Software transparency

The RS Fast Ethernet Hub does not require software configuring and is transparent to all systems and user applications including network management software.

3.2 LEDs

- **PWR LED:** Illuminates GREEN to indicate proper operation of the internal power supply.
- **COL LED:** Flashes when collisions occur on shared ports 1-5.
- **LINK LED:** Illuminates GREEN when connection is established between the port and the attached device. Each has its own LINK LED and should always be on during normal operation.
- **RX LED:** Illuminates Green to indicate that the port is receiving data from the attached device. Each has its own RX LED and flashes to indicate data traffic.

3.3 10 or 100 Manual Switch, Port 6

The 10 or 100 slide switch allows users to configure Port 6 as either a 100BASE-TX Fast Ethernet port or a 10BASE-T Ethernet port. It is located to the left of Port 6 on the front panel (see figure 2 for location of the switch relative to Port 6). When it is set to “10” it is configured as a 10Mbps port, and when set to “100” it is a 100Mb port. After switching from 100Mb to 10Mb or vice versa, it is necessary that the unit be powered down and back up to reset the internal buffers of the switch. Even through it is not always required, powering down and up will enable proper packet handling in all cases for both segments of the network.

3.4 Up-link switch port 1

The Hub is equipped with one up-link slide switch for port 1. This allows repeater-to-repeater connections without a special cross-over cable. The up-link switch is located to the left of port 1. Set the slide switch to the left “=" position for twisted pair cable segments from the port to a user device. Set the slide switch to the right “X” position for cascaded or up-link segment connections from the port to another repeater or hub in the network. Verify proper switch position by noting the ports LINK LED status which illuminates when proper link is established.

4.0 Troubleshooting

All RS Ethernet products are designed to provide reliability and consistent high performance in all network environments. Both the installation and operation of a Fast Ethernet Hub are simple procedures. Should problems develop during installation or operation, this section should help locate, identify and correct such problems. Please follow the suggestions listed below prior to contacting the RS Technical Helpline. However, if you are unsure of any procedure described in this section, or if the unit is not operating as expected, do not attempt to repair or alter the unit.
To determine whether a prospective network topology adheres to the collision domain diameter specification, the following formula should be applied to the worst case path through the network. The worst case path is the path between the two Fast Ethernet devices (DTEs) which have the longest round trip time.

\[
PDV = (\text{sum of cabling delays}) + (\text{sum of repeater delays}) + \text{(DTE pair delay)} + \text{(safety margin)}
\]

**PDV** is the Path Delay Value of the worst case path. For the network to adhere to IEEE standard, this value must be less than 512 BT. The safety margin is specified in BT and may be a value between 0 and 5. This margin can be used to accommodate unexpected delays, such as extra long patch cable. A safety margin from about 2 to 4 BT is recommended.

### Figure 6

A. Industry standard 100Mbps Hub  
B. 100m cat. 5 cables to user devices  
C. Cat. 5 cable for cascading

PDV is the Path Delay Value of the worst case path. For the network to adhere to IEEE standard, this value must be less than 512 BT. The safety margin is specified in BT and may be a value between 0 and 5. This margin can be used to accommodate unexpected delays, such as extra long patch cable. A safety margin from about 2 to 4 BT is recommended.

A typical example of PDV calculation is shown below. The example is illustrated in figure 6. Here, an integrator wishes to cascade two industry-standard Fast Ethernet hubs with 100m Category 5 user segments (i.e., from computer to Hub) and needs to know the total length of the Category 5 cable used to cascade the hubs. The variable “X” is used to represent the unknown maximum cascade length.
2.4 Connections to Auto-Negotiation 10/100 NICs
The RS Fast Ethernet Hub will function properly with 10/100 NICs (Network Interface Controllers) which support Auto-Negotiation. The Hub will establish link with any NIC which can send and receive the Fast Link Pulse (FLP) coding for the 100BASE-TX signaling system. When connecting a NIC to the unit, it may be necessary to reload the NIC’s drivers on the user device if the NIC has been communicating with a protocol other than 100BASE-TX (such as 10BASE-T).

2.5 Powering the hub
The RS Fast Ethernet Hub incorporates an internal universal power supply and has a recessed male IEC connector for the AC power cord at the rear-right. A 230Vac 50Hz power cord is supplied with each unit. Each units auto-ranging power supply support installation environments where the AC voltage is from 100 to 240 volts with an input frequency between 47 and 63 Hz, and consumes a maximum of 20 watts. In order to power down the unit, simply unplug either end of the power cable.

Note: The internal switch on port 6 has packet buffers, which need to be initialised when the unit is powered up. The “10 -100” manual switch for port 6 needs to be set to the desired speed before powering up the unit. If a change of speed is desired, power down the unit, change the manual switch setting, and power up the unit. (While changing the switch setting with power on will not damage the unit, it may lead to incorrect handling of the network traffic).

3.0 Operation
This chapter describes the function and operation of the RS Fast Ethernet Hub.

3.1 Hub functionality
The RS Fast Ethernet Hub provides switched (bridged) connectivity between two Fast Ethernet (100Mbps) segments or between one Ethernet (10Mbps) and one Fast Ethernet (100Mbps) segment. It segments the network traffic. The Hub has two switches on the front panel, one is UPLINK for port 1 and the other is 10 or 100Mbps speed selection for port 6. Note: The speed selection switch setting should be done before powering up the unit. The functions of the unit are described in following sections.

3.1.1. Filtering and Forwarding
Each time a packet is received on one of the ports, the decision is taken to either filter or forward the packet. Packets with errors are always filtered. For good packets, the filter and forward decisions are made based on the destination address contained in each packet. If the destination address is on the same segment from which the packet originated, then it is filtered and not forwarded to the other segment. If the destination address is not found to be a match in the address table for the originating segment, then it is forwarded to the other segment. If it is a new node address coming in which the switch did not previously know about, it “learns” the new address and puts it in the correct port address table. See “Address Learning” for more details.
2.4 Connections to Auto-Negotiation 10/100 NICs

The RS Fast Ethernet Hub will function properly with 10/100 NICs (Network Interface Controllers) which support Auto-Negotiation. The Hub will establish link with any NIC which can send and receive the Fast Link Pulse (FLP) coding for the 100BASE-TX signaling system. When connecting a NIC to the unit, it may be necessary to reload the NIC’s drivers on the user device if the NIC has been communicating with a protocol other than 100BASE-TX (such as 10BASE-T).

2.5 Powering the hub

The RS Fast Ethernet Hub incorporates an internal universal power supply and has a recessed male IEC connector for the AC power cord at the rear-right. A 230Vac 50Hz power cord is supplied with each unit. Each unit’s auto-ranging power supply support installation environments where the AC voltage is from 100 to 240 volts with an input frequency between 47 and 63 Hz, and consumes a maximum of 20 watts. In order to power down the unit, simply unplug either end of the power cable.

Note: The internal switch for port 6 has packet buffers, which need to be initialized when the unit is powered up. The “10-100” manual switch for port 6 needs to be set to the desired speed before powering up the unit. If a change of speed is desired, power down the unit, change the manual switch setting, and power up the unit. (While changing the switch setting with power on will not damage the unit, it may lead to incorrect handling of the network traffic).

3.0 Operation

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3.1 Hub functionality

The RS Fast Ethernet Hub provides switched (bridged) connectivity between two Fast Ethernet (100Mbps) segments or between one Ethernet (10Mbps) and one Fast Ethernet (100Mbps) segment. It segments the network traffic into two domains, ports 1-5 in one traffic domain and port 6 in another traffic domain, and it filters/forwards packets in both directions. The unit features a plug-and-play design. There is no software configuration to be done. The only hardware configuration required is setting the two switches on the front panel, one is UPLINK for port 1 and the other is 10 or 100Mbps speed selection for port 6.

Note: The speed selection switch setting should be done before powering up the unit. The functions of the unit are described in following sections.

3.1.1. Filtering and Forwarding

Each time a packet is received on one of the ports, the decision is taken to either filter or forward the packet. Packets with errors are always filtered. For good packets, the filter and forward decisions are made based on the destination address contained in each packet. If the destination address is on the same segment from which the packet originated, then it is filtered and not forwarded to the other segment. If the destination address is not found to be a match in the address table for the originating segment, then it is forwarded to the other segment. If it is a new node address coming in which the switch did not previously know about, it “learns” the new address and puts it in the correct port address table. See “Address Learning” for more details.
To determine whether a prospective network topology adheres to the collision domain diameter specification, the following formula should be applied to the worst-case path through the network. The worst case path is the path between the two Fast Ethernet devices (DTEs) which have the longest round trip time.

$$PDV = (\text{sum of cabling delays}) + (\text{sum of repeater delays}) + (DTE\ pair\ delay) + \text{(safety margin)}$$

PDV is the Path Delay Value of the worst case path. For the network to adhere to IEEE standard, this value must be less than 512 BT. The safety margin is specified in BT and may be a value between 0 and 5. This margin can be used to accommodate unexpected delays, such as extra long patch cable. A safety margin from about 2 to 4 BT is recommended.

A typical example of PDV calculation is shown below. The example is illustrated in figure 6. Here, an integrator wishes to cascade two industry-standard Fast Ethernet hubs with 100m Category 5 user segments (i.e., from computer to Hub) and needs to know the total length of the Category 5 cable used to cascade the hubs. The variable “X” is used to represent the unknown maximum cascade length.

**Table 2b: Worst case round-trip delay for Fast Ethernet device components**

<table>
<thead>
<tr>
<th>Component</th>
<th>Round-trip delay in Bit Times (BT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 TX DTEs</td>
<td>100</td>
</tr>
<tr>
<td>2 FX DTEs</td>
<td>100</td>
</tr>
<tr>
<td>1 FX and 1 TX DTE</td>
<td>100</td>
</tr>
<tr>
<td>2 T4 DTEs</td>
<td>138</td>
</tr>
<tr>
<td>1 T4 and 1 TX or FX DTE</td>
<td>127</td>
</tr>
<tr>
<td>Class I Repeater</td>
<td>140</td>
</tr>
<tr>
<td>Class II repeater with any</td>
<td>92</td>
</tr>
<tr>
<td>Combination of TX and FX ports</td>
<td><strong>Note: The delay is only 60 Bit Times for ports 1-5.</strong></td>
</tr>
<tr>
<td>Class II Repeater with T4 ports</td>
<td>67</td>
</tr>
</tbody>
</table>

**Note:** The delay is only 60 Bit Times for ports 1-5.

3.1.2 Address learning (address table maintenance)

The Hub is a state machine implementation, with an address table capacity of 1K address per segment. With such a large address table, the hub can meet the needs of larger networks. Table 3a shows exactly what the Hub is doing in each situation - including whether to add the new address to the Address Table based on each packet's source address. If the new packet's source address is not on the Address Table of the port which it was received, then the new source address is learned. The unit passes one and only one packet from the 10Mbps to 100Mbps side or vice versa, whenever it is in the learning mode. The Address Tables on both ports get flushed periodically to update the network status and to purge the inactive stations from both segments.

3.1.3 Throughput increase

With the Hub's capability of filtering, forwarding and address learning for both segments, it substantially increases the available bandwidth on both sides. As shown in figure 7, it keeps the local traffic on each side contained, and prevents unnecessary packets and bad packets from travelling to the other segment, thus increasing bandwidth on both sides.
2.0 Installation
This chapter provides instructions for installing the RS Fast Ethernet Hub.

2.1 Locating the Hub
The location of the Hub is dependent on the physical layout of the network and the workgroups to be bridge-isolated. The compact size of the unit allows it to be tabletop, shelf or wall-mounted. Brackets for vertical mounting are included. The cooling fan in the bottom of the unit exhausts air underneath the unit, so the space around the rubber feet should be kept clear.

Locate an AC socket that is within six feet (2 meters) of the intended position. The rugged metal case of the Hub will normally protect it from accidental damage in a lab or workplace setting. Keep an open area around the unit so that cooling can occur while the unit is in operation.

Each Hub is shipped with two mounting brackets (and screws), to allow the unit to be mounted in nearly any desired orientation or position. The brackets are attached to the case with one of the metal screws for each bracket. It is recommended that the brackets be attached to two opposite corners on the unit. When properly attached, the brackets will extend slightly below the base of the unit to allow clearance for the rubber feet.

2.2 Ethernet media connection
The Hub may be used as a bridge serving the needs of a small 100Mbps workgroup that connects to a large network environment (either 10 or 100Mb). In either case, 100Mbps connectivity is achieved using Category 5 twisted pair wiring.

2.3 Collision domain diameter
The collision domain diameter is the length of the longest path between any two devices in a single collision domain. A collision domain is defined as a cluster of network devices which are connected by means of a repeater or repeaters such that no bridging devices are present between any two devices in the cluster. In order to install an IEEE 802.3u compliant Fast Ethernet network, the collision domain, regardless of the actual network topology, must be less than 512BT (Bit Times). Bit Times are related to media type as shown in Table 2a.

<table>
<thead>
<tr>
<th>Media type</th>
<th>Round-trip delay in Bit time per meter (BT/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibre optic</td>
<td>1.000</td>
</tr>
<tr>
<td>Shielded TP cable</td>
<td>1.112</td>
</tr>
<tr>
<td>Category 5 cable</td>
<td>1.112</td>
</tr>
<tr>
<td>Category 4 cable</td>
<td>1.140</td>
</tr>
<tr>
<td>Category 3 cable</td>
<td>1.140</td>
</tr>
</tbody>
</table>

* Worst case delays taken from IEEE Std 802.3u-1995, actual delays may be less for a particular cable. Contact your cable supplier for exact cable specifications.

Each Fast Ethernet device component also has an associated BT delay, which depends on the physical signaling system employed. Table 2b shows each Fast Ethernet device component and the associated BT delay.

Note: There is only one DTE pair associated with any device-to-device path.

3.1.4 Software transparency
The RS Fast Ethernet Hub does not require software configuring and is transparent to all systems and user applications including network management software.

3.2 LEDs
- **PWR LED:** Illuminates GREEN to indicate proper operation of the internal power supply.
- **COL LED:** Flashes when collisions occur on shared ports 1-5.
- **LINK LED:** Illuminates GREEN when connection is established between the port and the attached device. Each has its own LINK LED and should always be on during normal operation.
- **RX LED:** Illuminates Green to indicate that the port is receiving data from the attached device. Each has its own RX LED and flashes to indicate data traffic.

3.3 10 or 100 Manual Switch, Port 6
The 10 or 100 slide switch allows users to configure Port 6 as either a 100BASE-TX Fast Ethernet port or a 10BASE-T Ethernet port. It is located to the left of Port 6 on the front panel (see figure 2 for location of the switch relative to Port 6). When it is set to “10” it is configured as a 10Mbps port, and when set to “100” it is a 100Mb port. After switching from 100Mb to 10Mb or vice versa, it is necessary that the unit be powered down and back up to reset the internal buffers of the switch. Even through it is not always required, powering down and up will enable proper packet handling in all cases for both segments of the network.

3.4 Up-link switch port 1
The Hub is equipped with one up-link slide switch for port 1. This allows repeater-to-repeater connections without a special cross-over cable. The up-link switch is located to the left of port 1. Set the slide switch to the left “=” position for twisted pair cable segments from the port to a user device. Set the slide switch to the right “X” position for cascaded or up-link segment connections from the port to another repeater or hub in the network. Verify proper switch position by noting the ports LINK LED status which illuminates when proper link is established.

4.0 Troubleshooting
All RS Ethernet products are designed to provide reliability and consistent high performance in all network environments. Both the installation and operation of a Fast Ethernet Hub are simple procedures. Should problems develop during installation or operation, this section should help locate, identify and correct such problems. Please follow the suggestions listed below prior to contacting the RS Technical Helpline. However, if you are unsure of any procedure described in this section, or if the unit is not operating as expected, do not attempt to repair or alter the unit.
4.1 Before calling for assistance

1. If difficulty is encountered when installing or operating the Hub, refer back to Section 2.0 installation and section 3.0 operation. Check to make sure that the various components of the network are functioning.

2. Check the cables and connectors to ensure that they have been properly connected and the cables/ wires have not been crimped or in some way impaired during installation.

3. Be certain that the AC power cord is plugged into a functioning electrical outlet. Make sure that the AC power cord is properly plugged into the unit. Use the PWR LED to verify that the unit is receiving proper power.

4. If the problem is isolated to a network device other than the Hub, it is recommended that the problem device be replaced with a known good device. Verify whether or not the problem is corrected. If not go to step 5 below. If the problem is corrected, the Hub and its associated cables are functioning properly.

5. If the problem continues after completing step 3 above, contact the RS Technical Helpline on Tel: 01536 402888.

4.2 When calling for assistance

Please be prepared to provide the following information.

1. A complete description of the problem, including the following points:
   a. The nature and duration of the problem
   b. Situations when the problem occurs
   c. The components involved in the problem
   d. Any particular application that, when used, appears to create the problem.

2. An accurate list of product model(s) involved, with serial number(s).

3. It is useful to include other network equipment models and related hardware, including personal computers, workstation, terminals and printers, plus the various network media types being used.

4. A record of changes that have been made to your network configuration prior to the occurrence of the problem. Any change to system administration procedures should all be noted in this record.

5.0 Technical specifications

Performance

Port 1-5:

Data rate: 100Mbps
PDV (Path Delay Value): 60BT

PORT 6:

Switch selectable, 10 or 100Mb/s

When set to “100”:
  Data rate: 100Mb/s
  PDV (Path Delay Value): 50BT (end node)

When set to “10”:
  Data Rate: 10Mbps

Figure 4 below shows how another 100Mbps workgroup can be added using a 100Mbps hub. By placing the RS Fast Ethernet Hub in the middle, it acts as a bridge separating the 10Mbps and the 100Mbps traffic domains.

An expanded 100Mbps workgroup connects to existing 10Mb network

Figure 5

The previous two examples show that the Hub not only provides connectivity between a 100Mbps workgroup and a 10Mbps workgroup, but it also segments the local traffic of the new and the existing segments from each other. This type of configuration is ideal for adding a new 100Mbps workgroup without slowing down the existing 10Mbps network with all the unwanted local packets from the new workgroup.

Consider yet another situation in figure 5 where a new 100Mbps user group is to be added to an existing 100Mbps network.

The Hub not only provides more 100Mbps ports to the network, it also adds a collision domain giving configuration flexibility to the new user group. The existing network can grow without having to worry about cable distance limitations and repeater hop counts associated with the new segment.

Joining two 100Mbps workgroups

Figure 6

The above figure shows two 100BASE-TX segments connected via the Hub. All the packet forwarding and filtering done by the Hub is transparent to the users, who only see one network in terms of node addresses. Performance of the network is enhanced as the available bandwidth on each segment will not be affected by the local traffic on the other segment. Since the Hub segments the network, the bandwidth available for each collision domain is maximized.
Manual speed selection of 10Mbps or 100Mbps on Port 6
Port 6 can be set by the user as either a 10BASE-T or 100BASE-TX port using the manual “10 - 100” switch on the front panel.

"Plug and Play" installation and operation
The Fast Ethernet Hub learns the network addresses of both network segments from the packets in the traffic, so there is no software set-up required. As nodes are added or changed, the unit learns the new network addresses and adapts its filtering and forwarding of packets automatically.

Segments 100Mbps networks for high performance and simplified expansion
The Hub provides a separate collision domain which maximises available bandwidth for both of the attached segments, enhancing network performance. The segmentation of the port 6 switch also resets cable distance limitations and repeater hop counts to enable easy expansion of 10Mbps networks.

Portable design makes network analysis easy
The compact design of the Hub makes it portable, allowing LAN managers to experiment with extending 100Mbps segments where cable distances and repeater hop counts might be limiting. The Hub, with port 6 operating as a bridge device, resets distance limitations when it is inserted into a network.

Operation is transparent to software
The RS Fast Ethernet Hub operates as a hardware switch. Its operation will not affect any standard software applications or SNMP network management platforms.

Compact enclosure allows for versatile installation
The compact physical size of the unit allows it to be installed in office or lab locations. Two mounting brackets are included for optional vertical mounting. The rugged metal enclosure provides durability, and the internal universal power supply enables one model to be usable worldwide.

1.4 Applications
The RS Fast Ethernet Hub is designed to provide connectivity between a 100Mbps (Fast Ethernet) workgroup segment to a 10Mbps (Ethernet) or 100Mbps (Fast Ethernet) segment. It is simple to install and use, making shared Fast Ethernet networks practical for connecting high performance user groups in a variety of ways. Since 10/100 NICs are widely available at low cost, 100BASE-TX Fast Ethernet has become desirable for many performance-oriented users. The Hub allows new 100Mbps network segments to be interoperable with existing 10Mbps networks, and be a separate collision domain in order to maximise performance of both segments. For example, Port 6 may be configured as a 10BASE-T port while Ports 1-5 are a new separate collision domain of shared 100BASE-TX ports.

Five 100Mbps nodes can be added to an existing 10Mb/s network

Packet processing on switched port, port 6
Processing type: Store and forward
Filtering and forwarding rate: Switch = “10”, 14,880 pps max.
Switch = “100”, 148,800 pps max.
Auto-learning: 1024 addresses per port
Packet buffers: 256KB, dynamically allocated and shared on both ports
Latency (not including packet time): 100 to 100Mb: 1µs
10 to 100Mb: 4µs
CPU Type: State machine
100 to 10Mb: 4µs

Maximum ethernet segment lengths
10BASE-T (unshielded twisted pair, 10Mb) - 100m (328 ft)
100BASE-TX (Cat. 5 twisted pair, 100Mb) - 100m (328 ft)

Network standards
Ethernet IEEE 802.3u: 100BASE-TX
IEEE 802.3: 10BASE-T

Operating environment
Ambient temperature: 32°F to 120°F (0°C to 50°C)
Storage temperature: -20°C to 60°C
Ambient relative humidity: 10% to 95% (non-condensing)

Power supply (internal)
AC Power connector: IEC-type, recessed, rear of chassis
Power input voltage: 100 to 240 Vac (auto-ranging)
Power input frequency: 47-63 Hz
Power consumption: 30 watts max.

Mechanical switches
Port 1 only: UP-LINK: MDI-X thumb-operated slide switch, converts RJ-45 port from a regular (= position) user segment port to a crossover (X position) up-link port for On/Off connection to a central hub or a cascaded hub.
Port 6 only: Thumb-operated slide switch, sets speed for the RJ-45 port to 10Mbps (“10” position) or 100Mbps (“100” position). For proper switching operation, note that the hub must be powered down and up to reset the internal switch buffers when the position of this switch is changed.

Packaging
Enclosure: High strength sheet metal.
Suitable for wiring closet shelf, wall or desktop mounting.
Dimensions: 9.1 in. D x 6.1 in. W x 1.3 in H (23.0cm x15.5 cm x 3.3 cm)
Weight: 1.55lb. (0.7kg)
Cooling method: Fan cooled, internal @ 7cfm

LED Indicators on Chassis
PWR: Steady On when power applied
COL: Collision, flashing when collision occurs on ports 1-5
LINK (per port): Steady On when twisted-pair link is operational
RX (per port): Activity, flashing when port is receiving data
Agency Approvals
UL Listed (UL 1950), cUL, CE
Emissions: meets FCC part 15, class A

Warranty
Three years, return to factory

5.2 Ordering Information
Magnum 600ES Personal Hub Plus

Federal Communications Commission
Radio Frequency Interference Statement
This equipment generates, uses and can radiate frequency energy and if not installed and used properly, that is in strict accordance with the manufacturer’s instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Important: RS Fast Ethernet Hubs contain no user serviceable parts. Attempted service by unauthorised personnel shall render any and all warranties null and void. If problems are experienced with the RS fast Ethernet hubs, consult the troubleshooting section of this manual.

1.2.1 Ports 1-5 100Mbps shared ports

Ports 1-5 are shared 100BASE-TX ports. Each port has its own link and RX (receive) activity LED built into the RJ-45 connector. The link LED will be on when proper cable connection is made on both ends, and the RX LED will flash to indicate activity when the port is receiving data. The up-link switch for port 1 is located on the left side and enables port 1 to either connect to a user station or to another hub. See section 3.4 for more details about up-link.

1.2.3 Port 6: switched 10 or 100Mbps port

Port 6 is located on the right front panel. It may be user-selected to operate either as a 10BASE-T port or as a 100BASE-TX port using the “10 - 100” manual switch. The switched port offers great flexibility in connecting the unit - as an additional 100Mbps segment - to an existing 10 or 100Mbps network. Because this port is segmented from the other ports, it provides a separate collision domain.

1.3 Features and benefits
- Adds 100Mbps ports as a collision domain to a 10 or 100Mbps segment

Five 100Mbps ports can be added to either a 10Mbps Ethernet or 100Mbps Fast Ethernet segment as a new collision domain, so that configurability and performance of both the new and the existing segments are maximised.
1.0 Introduction

1.1 Inspecting the package and product

Inspect the contents of this package for any signs of damage and ensure that the items listed below are included.

**This package should contain:**

- 1 x Fast ethernet hub
- 1 x AC Power Cord
- 2 x Mounting brackets for optional mounting
- 2 x Mounting screws for use with the brackets
- 1 x Installation and user guide

1.2 Product Description

The RS Fast Ethernet Hub is an easy to install, cost-effective 100BASE-TX hub that also has a switched port that can be configured to provide “bridged” connectivity between a 100Mbps segment and a 10Mbps segment or between two 100Mbps segments. It is a complete “plug and play” operational unit enclosed in a lightweight, compact, rugged metal enclosure suitable for office or lab locations. Each unit has its own internal power supply. The Hub is easily installed as an addition to an existing 10 or 100Mbps network segment and is suitable for horizontal or vertical mounting. The Hub is ideally suited for adding a Fast Ethernet workgroup to an existing 10Mbps or 100Mbps network. A small 100Mbps workgroup connects to the five ports while another workgroup or existing network segment - a separate collision domain of 10Mbps or 100Mbps units - connects to port 6. For expansion of the five 100Mbps ports, an additional 100Mbps hub can be cascaded from port 1. Each domain can have its own local servers and other local traffic. Thus, the Hub can bridge-isolate one collision domain from the other - separating the local traffic between each workgroup’s users and server from the rest of the network. The Hub will filter and forward the packets to / from port 6 and the other ports, thereby giving more bandwidth to each domain for maximum network performance.

The Hub chassis houses one main board for the five hub ports plus a daughter board for the switched port. It has an internal power supply and a small cooling fan in the bottom. The front of the chassis consists of five shared 100Mbps RJ-45 ports and one 100Mbps or 10Mbps switched RJ-45 port. There is an up-link (UP-LINK) switch for Port 1. The Hub has power (PWR) and collision (COL) LED’s for the unit, and link (LINK) and receive (RX) activity LEDs for each of the five shared ports and for Port 6. Rubber feet on the bottom provide a sturdy grip and clearance for the exhaust of the cooling fan. The internal power supply is auto-ranging AC power input of 115-230 Vac, 50/60 Hz. The recessed male IEC power connector is located at the rear-right. Two mounting brackets for optional wall mounting are supplied with each unit.
Fast Ethernet Hub

Instruction Leaflet

5 port hub RS stock no. 288-5825

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