S.No	PROTOCOL	RANGE	SPEED	FREQUENCY BANDWIDTH	MODULATION SCHEME	POWER CONSUMPTION	DATA RATE	ERROR CONTROL	ENCRYPTION	SPECIAL FEATURES	APPLICATION DOMAIN
1	RS232	Short(<50ft)	20,000bps	20KHz	None	Low	Up to 115.2 kpbs	None	None	Legacy serial communication	Computers and peripherals, Robotics
2	RS485	Moderate (4000ft)	10Mbps	300 kHz to 10 MHz	Differential	Low	Up to 10 Mbps	CRC, Parity	None	Noise immunity, Multi point	Industrial automation, Medical devices
3	SPI	Short(<1m)	100 kbit/s - 10 Mbps	100 kHz and 10 MHz	None	Low	Mbps to Gbps	None	None	High-Speed, Full-Duplex	Databases, IoT, Embedded systems
4	I2C	Short(<1m)	100 kbit/s - 3.4 Mbit/s	up to 1000 kHz	None	Low	100 kbps to 3.4 Mbps	None	None	Multi-master, Low-pin count	Embedded Systems, Industrial automation
5	CAN	Moderate (3280ft)	1 Mbit/s	125 kHz to 1 MHz	Differential	Low	Up to 1 Mbps	CRC, ACK/NAK	None	Robust, Multi-master, Real-time	Transportaion, Aerospace
6	LIN	Short(<20m)	19.2 kbit/s	100 kHz to 200 kHz	None	Low	Up to 20 kbps	CRC, Parity	None	Low-cost, Single-master	Safety systems, telematics systems
7	FLEXRAY	Moderate (3280ft)	Up to 10 Mbit/s	20MHz to 50MHz	Differential	Low or Moderate	Up to 10 Mbps	CRC, Acknowledgment	None	Real-time, High-Reliability	Advanced driver assistance systems
8	Bluetooth	Short to Moderate	Up to 50 Mbit/s	2.4 GHz	FHSS	Low	Up to 3 Mbps	CRC, ARQ	Yes (LE)	Low power, Wireless audio	Automotive, Data transfer
9	Zigbee	Short to Moderate	Up to 250 kbit/s	2400-2483.5 MHz	DSSS	Low	Up to 250 kbps	CRC, ACK	Yes (SE)	Low Power, Mesh networking	Smart cities, Health care
10	Wi-Fi	Short to Long	Up to 1 Gbit/s	2.4 GHz and 5 GHz	OFDM	Moderate	Up to Gbps	CRC, ARQ	Yes (WPA)	High data rates, Internet access	Manufacturing, Mobile devices
11	MiWi	Short to Moderate	Upto 100 kbps	2.4 GHz	DSSS	Low	Up to 250 kbps	CRC, ACK	Yes	Low power, Wireless sensor networks	Asset tracking, Security systems
12	nRF24	Short to Moderate	Up to 2 Mbps	1 MHz	GFSK	Low	Up to 2 Mbps	CRC, ACK	None	Low power, Low-cost	keyless entry systems, Telemetry
13	Wireless LAN	Short to Long	Up to 9.6Gbps	2.4 GHz and 5 GHz	OFDM	Moderate	Up to Gbps	CRC, ARQ	Yes (WPA)	Internet access, Mobility	Retail, Public safety
14	Wireless PAN	Short to Moderate	up to 480Mbps	2.400 to 2.483 GHz.	Various	Low or Moderate	Up to Mbps	CRC, ARQ	Yes (WPAN)	Short-range, Personal Area	Portable devices, Gaming
15	UWB	Very Short (<10m)	480 Mbps	500MHz to 7.5 GHz	Impluse Radio	Low or Moderate	Up to Gbps	Error detection	Yes (UWB)	Precision ranging, Low power	Real time location tracking

16	Ethernet	Short to Long	Up to 10 Gbps	Up to 2000 MHz	Various	Low or Moderate	Up to Gbps	CRC, ARQ	Yes (WEP, WPA)	High-speed, LAN connectivity	Setting up a home or office network
17	USB	Short (<5m)	Up to 40 Gbps	240 MHz	None	Low	Up to 40 Gbps	None	Yes	Plug-and-play, High speed	Connecting industrial devices such as sensors and controllers
18	Fire Wire	Short (<4.5m)	400 Mbps to 800 Mbps	400 MHz	Various	Low or Moderate	Up to 3.2 Gbps	None	Yes	High-speed, Peer-to-peer	Connecting high-end audio and video devices
19	PCIe	Short (<1m)	Up to 15.75 GB/s	Up to 32 GHz	None	Low	Up to 32 GT/s	None	Yes	High-speed, Peripheral connectivity	Graphics cards
20	InfiniBand	Short to Moderate	Up to 400 Gbps	Up to 100 Gb/s	Various	Low or Moderate	Up to 2000 Gbps	CRC, Flow Control	Yes	High-speed, Data center networking	Financial trading
21	CAN-FD	Moderate (3280ft)	5 Mbit/s	Up to 8 Mbit/s	Differential	Low	Up to 10 Mbps	CRC, ACK/NAK	None	Enhanced data rates, Real-time	Automotive, Medical devices
22	LON	Short to Moderate	Up to 1.25 Mbps	Up to 148 KHz	FSK, DSSS	Low or Moderate	Up to 78.6 kbps	Error detection	Yes (AES- 128)	Scalable, Building Automation	Utilities, Building automation
23	KNX	Short to Moderate	up to 100 kbit/s	Up to 868 MHz	FSK, ASK, DSSS	Low	Up to 9.6 kbps	CRC, Parity	Yes	Building automation, Home control	Energy metering and management
24	PROFIBUS	Short to Moderate	Up to 31.25 kbps	Up to 800 MHz	Manchester Coding	Low or Moderate	Up to 12 Mbps	CRC, ACK	None	Industrial automation, Fieldbus	Process and Factory automation
25	Modbus	Short to Moderate	Up to 38.4Kbps	1hz and 20Khz	Various	Low or Moderate	Up to 115.2 kpbs	CRC, Parity	None	SCADA, Industrial Automation	Machine control, SCADA systems
26	Z-Wave	Short to Moderate	up to 100 kbit/s	1GHz to 2.4GHz	GFSK	Low	Up to 100 kbps	CRC, ACK	Yes (AES- 128)	Low power, Home control	Smart lighting, Smart locks
27	LoRa	Long (miles)	0.3 kbit/s and 27 kbit/s	Up to 915 MHz	Various	Low	Up to 50 kbps	Forward Error correction	Yes (AES)	Long-range, Low power	Smart agriculture, Industrial IoT
28	Sigfox	Long (miles)	100 kbps to 600 kbps	600Hz	UNB	Low	Up to 100 kbps	None	Yes (AES- 128)	Ultra-low power, Wide area	Environmental monitoring
29	6LoWPAN	Short to Moderate	Up to 250 kbps	Up to 868 MHz	Various	Low	Up to 1 Mbps	CRC, ACK	Yes (AES- 128)	IPv6 over Low-power WPAN	Smart home automation
30	NFC	Very Short (<4cm)	Up to 424 kbps	13.56 MHz	Various	Low	106-424 kbps	None	Yes (AES- 128)	Contactless, Mobile payments	Contactless payments
31	RFID	Short to Moderate	Upto 200 Kph	3 to 30 MHz	Various	Low	Up to 1 Mbps	None	Yes (AES- 128)	Automatic identification	Inventory management
32	NB-IoT	Long (miles)	26Kbs	Up to 1980 MHz	Various	Low	Up to 250 kbps	CRC, Retransmission	Yes (AES- 128)	Cellular IoT, Low power	Precision agriculture
33	LTE-M	Long (miles)	Upto 4 Mbps	1785–1805 MHz	OFDMA	Low or Moderate	Up to 1 Mbps	CRC, Retransmission	Yes (AES- 128)	Cellular IoT, Low power	Wearable devices
34	5G NR	Short to Long	Up to 20 Gbps	60 KHz to 120 KHz	OFDMA	Low or Moderate	Up to Gbps	CRC, ARQ	Yes (AES- 128)	High speed, Low latency	Smart manufacturing

35	PoE	Short to Long	Up to 1 Gbit/s	2.4 GHz	Differential Manchester encoding	Low or Moderate	Up to Mbps	Checksum, FEC	Yes	Power delivery method	IP Cameras, LED lighting
36	LoRaWan	Short to Long	250 bps - 22 kbps	903 MHz to 914 MHz	CSS	Low	0.3 Kbps to 50 Kbps	CRC, FEC	Yes (AES)	Long range, Low power	Smart transportation
37	Token Ring	Long (miles)	Up to 1.25 Mbps	Up to 108 Hz	Differential Manchester encoding	Low	Up to 100 Mbps	CRC	None	Token Passing, Reliable Delivery	Manufacturing plants
38	FDDI	Long (miles)	100 Mbps	31.25 MHz	Manchester encoding	Low	100 Mbps	NRZI, FCS	Yes	High data rate, Long distance capability	Storage area networks
39	ATM	Short	45 Mbps - 622 Mbps	100 Hz	BPSK/ QPSK	Low	Up to 1 Gbps	HEC, FEC	Yes (AES)	Fixed-length cells, Virtual circuits	Enterprise networks
40	Fiber Optic	Short to Long	Up to 10 Gbps	1 THz to 1000 THz	OOK/ PAM/ QAM	Very low	Up to Tbps	CRC, ARQ, FEC	Yes	High band width, Long distance	Telecommunications, Medical inaging