XICHTEE

LMPSH-IP & HRNL-25W EMBER+ / S101 PROTOCOL GUIDE

Public protocol integration guide

DATASHEET

EMBER+

v1.3.0 RELEASE | BUILD 310

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Purpose

This guide documents both XICHTEE Ember+ roles: the browsable provider and the device-local lazy consumer that monitors one remote scalar parameter for Logic. It covers TCP/S101 framing, Glow operations, qualified numeric paths, value and online semantics, notifications, Cluster ownership and verified read-only examples.

NOTE This is a public guide to the implemented product interface. Browse the live provider and verify the running firmware before relying on version-specific nodes or parameters.

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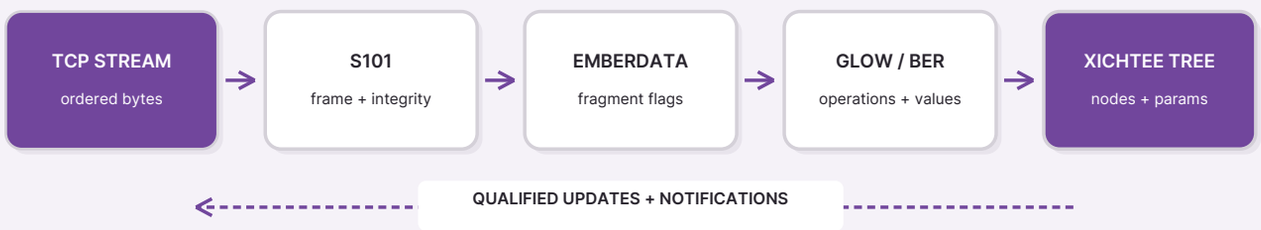
01 · Overview

Provider and consumer roles

The device can expose its own hierarchical Glow tree as an Ember+ provider and can also open one outbound lazy-consumer connection to another provider. The provider role supports browsing, control and notifications. The consumer role is monitoring-only: one remote scalar value becomes a typed Logic input and is never written by the XICHTEE device.

EMBER+ PROTOCOL STACK

A production consumer should use an Ember+ library and preserve message boundaries above TCP.



GetDirectory starts discovery; SetValue writes; QualifiedParameter data confirms authority.

ITEM	IMPLEMENTED CONTRACT
Provider role	XICHTEE accepts Ember+ client connections for browse, control and notifications.
Consumer role	XICHTEE opens one outbound connection and monitors one numeric Parameter path for Logic.
Provider transport	Plain IPv4 TCP server; stored default port 9000.
Framing	S101 Variant 1 escaped/CRC and Variant 2 length-delimited.
Application	EmberData carrying ASN.1 BER-encoded Glow DTD 2.50.
Elements	Nodes and scalar parameters. No public Matrix, Function or Stream elements.
Provider values	Integer, Boolean and UTF8String for implemented writes.
Consumer values	Boolean, representable Integer and finite Real values; monitoring only.
Security	No Ember authentication or TLS.

NOTE A successful TCP send is never proof that a SetValue was applied or persisted. Verify the provider's authoritative QualifiedParameter value.

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02 · Configure and connect

Enable one or more Ember provider listeners

In Socket Config, set the Ember+ TCP port and request one or more Ember sockets, save, and perform the requested restart. The licence must permit Ember+ operation. Runtime availability also depends on the shared network-socket budget.

SETTING	VALUE / GUIDANCE
Ember Port	1–65535; stored default 9000.
Ember Sockets	0 disables the provider. Up to four contexts are supported; a configured outbound consumer reserves one and reduces the provider maximum to three.
Client tool	Use an Ember+ Viewer or library that supports S101 and Glow.
Connect	Open TCP; expect no greeting. Start with GetDirectory on root/device.
Keepalive	Send S101 keepalive requests during otherwise idle sessions.
Reconnect	Browse again and restore all interest/subscriptions; they are connection-local.

Enable the lazy consumer

In Network Config / Socket Config, enter the remote provider IPv4 address, TCP port and stale timeout, then enable Ember+ Consumer. The form immediately plans one Consumer connection; if no capacity is available, the unchecked control is unavailable until capacity is freed. Choose a numeric Parameter path with Browse provider, then save and restart. The Ember+ licence must be available. The complete configuration is device-local and is not copied by Cluster synchronisation.

SETTING	VALUE / GUIDANCE
Enable Ember+ Consumer	Plans one Consumer connection immediately in the current form. If the unchecked control is unavailable, reduce another requested allocation first.
Provider IPv4	Usable unicast IPv4 address; not unspecified, loopback or multicast.
Provider port	1–65535; default 9000.
Numeric path	1–6 dot-separated non-negative components; each 0–2147483647. A blank path may be saved as awaiting selection, but it does not start monitoring or reserve a runtime Consumer connection.
Stale timeout	1,000–3,600,000 ms in 100 ms steps; default 5,000 ms.
Connection use	A valid selected path uses one outbound TCP connection; the maximum simultaneous inbound provider clients becomes three.

IMPORTANT The lazy consumer resolves only a numeric Glow path. If the remote provider renumbers its tree, re-browse that provider and verify the configured path before restoring automation.

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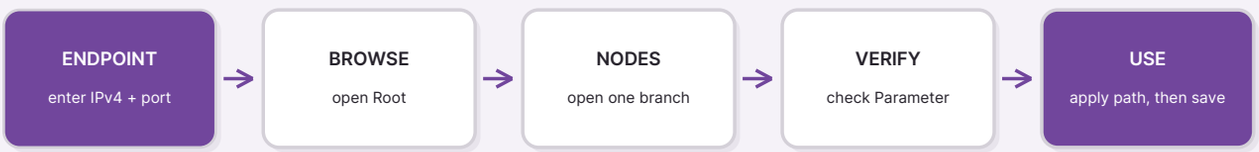
Browse and choose a Parameter

BROWSE PROVIDER WORKFLOW

The provider tree is explored on demand; a complete tree is not loaded at once.



Using a verified path updates the form only. SAVE & REBOOT applies it.

STEP	OPERATOR RESULT
Browse provider	Opens Root after the current IPv4 address and port have been checked. The browser can navigate up to 16 numeric levels.
Open a Node	Lists that Node's direct children. Every row shows its numeric number, kind and Identifier, so the next numeric path component is visible.
Filter / Load more	Filters the current page only. A page has at most eight direct children; Load more continues that same directory.
Verify a Parameter	Checks the selected ordinary scalar Parameter, including its type, current value and online state. Only a compatible Boolean, Integer or finite Real value can be used.
Use parameter	Copies a verified 1–6 component numeric path into Network Config. It does not save or change the remote provider.

NOTE Browsing is read-only. If no separate browser connection is available while monitoring is active, monitoring is briefly paused and reconnects when browsing closes; the Remote Ember+ Logic value is unavailable during that interval.

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Provider-client connection lifecycle

CONSUMER LIFECYCLE

Treat the provider tree as discoverable and versioned rather than hard-coding one startup snapshot.

CONNECT

Open plain TCP to the configured port; no Ember greeting follows.

DISCOVER

The browser reads Root and only the branches the operator opens.

INTEREST

The runtime Consumer reads the target containing directory to establish update interest.

RECOVER

On close or authority transition, reconnect, rebrowse and restore interest.

An idle connection may close after about 15 minutes without receive or transmit progress.

IMPORTANT The Ember TCP service is unauthenticated and unencrypted. Restrict it to an isolated trusted control network, VPN or protected tunnel.

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03 · S101 anatomy

Variant 1 · escaped frame with CRC

Variant 1 begins with FE, carries an escaped payload and escaped CRC-16/X-25, and ends with FF. CRC is calculated on the unescaped S101 payload, complemented, and transmitted low byte first.

S101 VARIANT 1 · KEEPALIVE REQUEST

The eight-byte validated frame carries the four-byte payload 00 0E 01 01.

1 BYTE	4 BYTES	1 BYTE	1 BYTE	1 BYTE
BOF	S101 PAYLOAD	CRC LOW	CRC HIGH	EOF

FE begins and FF ends one escaped Variant-1 frame.

Escape FD, and every unescaped byte FD or F8–FF, as FD then byte XOR 20.

CRC-16/X-25: init FFFF, reflected polynomial 8408, final complement, little-endian.

VALIDATED KEEPALIVE REQUEST

FE	00 0E 01 01	94	E4	FF
BOF	PAYLOAD	CRC LOW	CRC HIGH	EOF

All labels and examples are vector text and remain searchable in the PDF.

TWO ACCEPTED S101 VARIANTS

XICHTEE accepts both variants from external Ember+ clients. The outbound Consumer begins its own requests in Variant 1.

VARIANT 1

FE · escaped payload · escaped CRC low/high · FF. Most interoperable framing.

VARIANT 2

F8 · length descriptor · big-endian length bytes · payload. No escaping or CRC.

For Variant 2, descriptor bits 0–2 give 0–7 length bytes; upper bits must be zero.

NOTE The Consumer sends its own GetDirectory and keepalive requests in Variant 1. It accepts Variant 1 or Variant 2 replies, and answers a provider keepalive in the framing in which that request arrived. TCP read boundaries are not S101 frame boundaries.

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04 · EmberData and Glow

Single-packet EmberData header

FIELD	BYTES / VALUE	MEANING
Slot	00	S101 slot 0.
Message type	0E	Ember.
Command	00	EmberData.
Version	01	S101 command version.
Fragment flags	C0	Single packet. 80 first, 00 middle, 40 last.
DTD	01	Glow.
App byte count	02	Two application bytes follow.
App bytes	32 02	Glow DTD 2.50.
Body	variable	ASN.1 BER-encoded Glow tree.

Supported operations

OPERATION	VALUE	IMPLEMENTED BEHAVIOUR
GetDirectory	32 / 0x20	Browse a node or parameter and establish interest.
Subscribe	30 / 0x1E	Track a parameter or selected node; current value is published.
Unsubscribe	31 / 0x1F	Remove connection-local interest; root clears all.
SetValue	Parameter contents	Apply Integer, Boolean or UTF8String where supported.
NULL	Glow NULL	Accepted syntactically but does not change a value.

Directory compatibility

A general client browsing the XICHTEE provider can use a directory field mask of 0. The provider also recognises identifier (1), tree (3) and value (4) requests. The XICHTEE runtime Consumer requests All (-1) for Root when its selected path has one component, or for the target's containing Node when it is deeper. The visual browser also requests All for the directory currently being opened. Large replies can use First/Middle/Last EmberData fragments; reassemble the logical message before interpreting BER.

IMPORTANT The provider does not supply a dependable formal error result for every unknown path, wrong type, malformed BER or ignored write. Read the qualified value back and keep optimistic UI state provisional.

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05 · Browse the tree

Start at Root → Device

Numeric identifiers are scoped by their parent. Always retain and send the full qualified path; a bare parameter ID such as 1 is ambiguous.

TOP-LEVEL XICHTEE GLOW TREE

S is the device/licence segment maximum; P is one of ten presets; E is one of ten Custom Effects.

Root	NODE	GetDirectory 0
1 · Device	NODE	LMPSH-IP or HRNL-25W
90 · Segments	NODE	Segment 1..S
20 · Network Config	NODE	IP + socket branches
40 · System Status	NODE	telemetry + client counts
60 · Presets	NODE	Preset 1..10
80 · Custom Effect	NODE	Custom Effect 1..10
70 · Rules	NODE	five rules per segment

Root browsing alone does not subscribe the consumer to every periodic System Status value.

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QUALIFIED PATH · SEGMENT 1 RULE 1 ACTIVE

The same path is written with slash or dotted notation: 1/70/1200/710/7000.

NODE 1	NODE 70	NODE 1200	NODE 710	PARAM 7000
DEVICE	**RULES**	**SEGMENT RULES**	**RULE 1**	**ACTIVE**

Nodes 1200 and 710 are the Segment 1 and Rule 1 instances.

Parameter 7000 is a read/write Boolean, saved automatically; current ownership still applies.

GetDirectory on this parameter returns value/attributes and establishes interest.

COPYABLE DOTTED PATH

1	70	1200	710	7000
DEVICE	RULES	SEGMENT 1	RULE 1	ACTIVE

All labels and examples are vector text and remain searchable in the PDF.

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06 · Device, segments and status

Device and segment formulas

PATH / FORMULA	TYPE	MEANING / RANGE
1/8	String RW	Device Name · up to 31 characters.
1/14	Enum RW	Active Mode · 0 means one segment; S−1 means S segments.
1/90/(199+s)	Node	Segment s, where s = 1..S.
Segment RGB	Integer RW	Each component 0–255.
Segment Count	Integer RW	1–120 LEDs.
Segment Name	String RW	Up to 31 characters.

Segments 1–5 parameter IDs

SEGMENT	RED / GREEN / BLUE	COUNT	NAME
1	1 / 2 / 3	7	50
2	11 / 12 / 13	15	51
3	21 / 22 / 23	16	52
4	41 / 42 / 43	17	53
5	61 / 62 / 63	18	54

Segments 6 and above

For segment s ≥ 6, let b = 2000 + (s−6) × 10. Under node 1/90/(199+s), parameters b+0, b+1 and b+2 are RGB; b+3 is LED Count; b+4 is Name. LMPSH-IP exposes up to two segments; HRNL-25W can expose up to 45 where licensed.

IMPORTANT Use the normal authenticated web interface for network configuration. The Ember transport itself is unauthenticated and unencrypted.

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Public-safe network and status paths

PATH	TYPE	MEANING
1/20/21/22	String R	IP Address.
1/20/21/23	String R	Subnet Mask.
1/20/21/24	String R	Gateway.
1/20/21/36	Boolean R	DHCP Enabled.
1/20/30/31..35	Integer RW	HTTP, Ember, TSL, Pro-Bel and OSC ports · 1–65535.
1/20/30/37	Integer R	Syslog port · 514.
1/20/30/38	Integer R	NTP port · 123.
1/40/4 · /401	Integer R	CPU Core 0 / Core 1 percentage.
1/40/5 · /6	Integer R	RAM / flash usage percentage.
1/40/46	String R	Core temperature.
1/40/461 · /462	String R	Aux sensor 1 / 2.
1/40/463 · /464	Boolean R	GPI 1 / 2.
1/40/56 · /57	Bool / String R	Ethernet link state / speed.
1/40/540	String R	Uptime.
1/40/580 · /581	String R	LED state HEX / RGB text.
1/40/69	Boolean RW	Swap Segments for two-segment operation.

Client-count nodes

PATH	COUNT
1/40/42/1	Ember clients
1/40/43/1	HTTP clients
1/40/84/1	TSL clients
1/40/85/1	Pro-Bel clients
1/40/86/1	Recent OSC senders

NOTE Browse or subscribe to System Status node 40 or the required parameters to receive periodic status changes. A simple root browse is not sufficient.

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07 · Presets and Custom Effects

Preset path and parameter formula

For preset p = 1..10, the node is 1/60/(99+p) and parameter base is b = 1000 + (p−1) × 20.

OFFSET	PARAMETER	TYPE / RANGE
0–2	Red / Green / Blue	Integer RW · 0–255
3	Name	String RW · 31 characters
4 / 7	Start / Stop Effect	Enum RW · numeric values below
5 / 8	Start / Stop Direction	Enum RW · 0 left→right, 1 right→left
6 / 9	Start / Stop Time	Integer RW · 0–10000 ms
10	Constant Mode	Enum RW · 0–19
11	Constant Direction	Enum RW · 0 left, 1 right, 2 centre out
12	Constant Period	Integer RW · 50–10000 ms
13	Fade Out Time	Integer RW · 50–10000 ms
14	Morse Text	String RW · A–Z, 0–9, spaces · 64 chars

Effect values

FIELD	NUMERIC VALUES
Start / Stop	0 Instant, 1 Wipe, 2 Blink, 3 Fade, 4 Breathing, 5 Strobe, 6 Chase, 7 Phone Ring, 10–19 Custom Effects 1–10. Values 8–9 are not used.
Constant	0 Static, 1 Wipe, 2 Blink, 3 Fade, 4 Breathing, 5 Strobe, 6 Chase, 7 Phone Ring, 8 Morse, 9 Audio Monitor, 10–19 Custom Effects.

NOTE Use the numeric values above for Start/Stop Custom Effects; do not infer value numbers only from a consumer's displayed enumeration line order.

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Audio Monitor child

Under preset p, the Audio Monitor node is 1/60/(99+p)/(1599+p). Let a = 800 + (p−1) × 20.

OFFSET	PARAMETER	TYPE / RANGE
0 / 1	Left / Right Channel	Enum RW · 0–31 represents channel 1–32
2 / 3	Low-Mid / Mid-High Threshold	Integer RW · 0–100; reordered if necessary
4–6	Low Red / Green / Blue	Integer RW · 0–255
7–9	Mid Red / Green / Blue	Integer RW · 0–255
10–12	High Red / Green / Blue	Integer RW · 0–255

Custom Effects

For effect e = 1..10, the node is 1/80/(1699+e) and base is c = 14000 + (e−1) × 10.

OFFSET	PARAMETER	BEHAVIOUR
0	Custom Effect Name	String RW · 31 characters
1	Live Preview	Boolean RW · only one effect owns preview at a time
2	Timeline Sync	Boolean RW
3	timelineposition	Integer RW · 0–60000 ms
4	Play	Momentary Boolean; write true, authoritative value returns false
5	Pause	Momentary Boolean; write true, authoritative value returns false

NOTE Live Preview, Play, Pause and timeline position are runtime controls. Preview ownership changes can generate updates for both the old and new effect.

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08 · Rules and time triggers

Five rules per segment

For segment s = 1..S and rule r = 1..5: Segment Rules node = 1199+s; Rule node = 710 + (s−1)×10 + (r−1); parameter base q = 7000 + (s−1)×100 + (r−1)×10.

OFFSET	PARAMETER	TYPE / RANGE
0	Active	Boolean RW · automatic state retention
1	Preset ID	Enum RW · 0–9
2	TSL Index	Integer RW · effective −1..9999
3	TSL Bit	Integer RW · 0–3
4	OSC Path	String RW · 63 characters
5	OSC Match Mode	Enum RW · Trigger, Exact, Range, String
6 / 7	OSC Value A / B ×1000	Integer RW · −2000000..2000000
8	OSC String	String RW · 31 characters
9	Trigger Source	Enum RW · Disabled, GPI 1/2, Logic 1..10

Active ownership

An Active write is ignored while a maintained GPI/Logic Follow input owns the rule. The provider publishes the current authoritative value so the consumer can correct optimistic state. Rule Active is saved automatically and restored from the last verified save. Maintained inputs and current Cluster authority can replace the restored state.

NOTE The directory may advertise a wider TSL Index maximum, but the effective accepted range is −1..9999. Integrations should use this narrower contract.

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Time Trigger compatibility subset

A rule's Time Trigger node is 1800 + (s−1)×10 + (r−1), below the qualified Rule path. The parameter base is 12000 + (s−1)×100 + (r−1)×20.

SLOT	UNIQUE PUBLICLY SAFE OFFSETS	FIELDS
1	0–13	Mode, Action, Hour, Minute, Day, Month, Year, Monday–Sunday
2	14–19	Mode, Action, Hour, Minute, Day, Month

Time values

FIELD	VALUE
Mode	0 Disabled, 1 Once, 2 Daily, 3 Weekly
Action	0 Set FALSE, 1 Set TRUE
Hour / Minute	0–23 / 0–59
Day / Month / Year	0 clears the date; otherwise a valid date with year 1970–9999
Weekdays	Boolean Monday through Sunday on Slot 1

IMPORTANT Do not address Slot 2 Year or weekday fields in this firmware baseline: those advertised IDs are not independent. Configure the complete second slot through the authenticated web UI until a later protocol baseline states otherwise.

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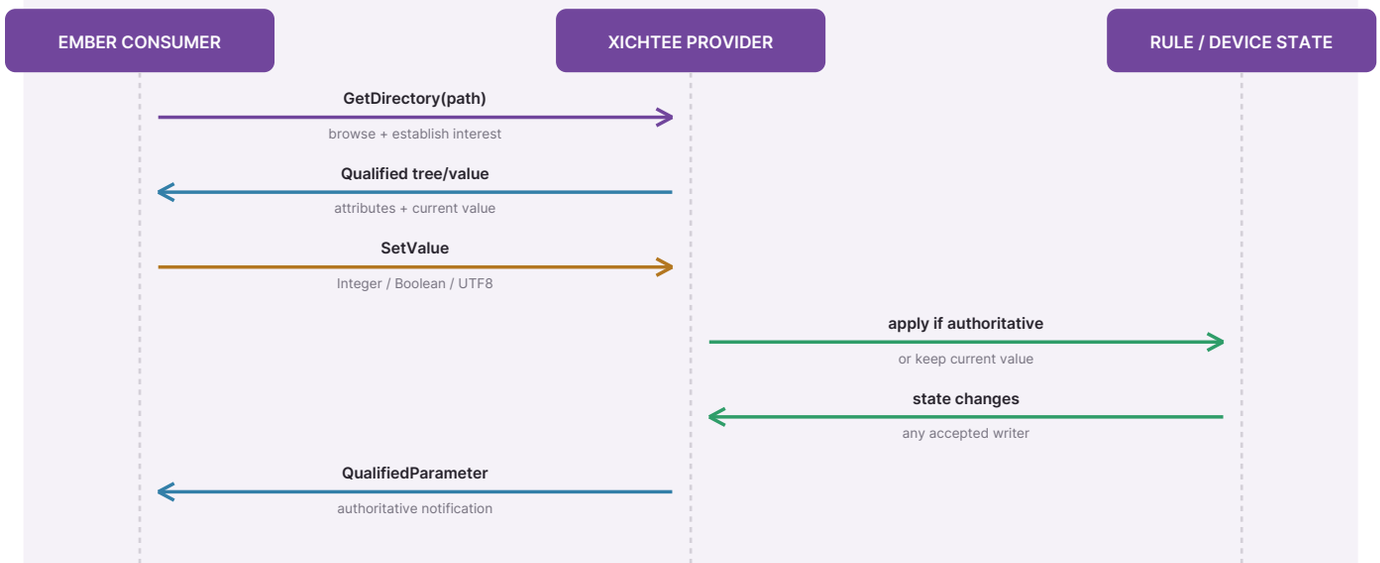
09 · Interest and notifications

Directory access can establish interest

A successful GetDirectory on a parameter establishes interest in that parameter. A successful GetDirectory on a node establishes interest in parameters below that ancestor. Ordinary Rule Active changes therefore do not require a numeric StreamIdentifier.

BROWSE, WRITE AND OBSERVE

Interest and explicit subscriptions live only for the current TCP connection.



Verify the echoed value; keep optimistic local state provisional until it agrees.

INTEREST SOURCE	BEHAVIOUR
GetDirectory parameter	Later changes for that parameter are published.
GetDirectory ancestor node	Later changes below that ancestor are published.
Subscribe parameter	Current value is published immediately, then later changes.
Subscribe selected node	Current contained values and later changes are published.
Unsubscribe node	Removes parameter subscriptions below it; root clears all interest.
Reconnect	All directory interest and subscriptions must be rebuilt.

NOTE Rule Active notifications can originate from Ember+, web, OSC, Pro-Bel, GPI/Logic, NTP or accepted Cluster live state. Unchanged values do not generate a change notification.

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10 · Working read-only client

Get Segment 1 / Rule 1 / Active

This byte-exact, non-mutating Variant-1 GetDirectory request targets 1.70.1200.710.7000. It returns the current Boolean and establishes interest. The example validates S101 CRC but intentionally leaves BER/Glow decoding to a production Ember+ library.

```
import socket

DEVICE, PORT = "192.0.2.10", 9000  # documentation-only address
REQUEST = bytes.fromhex("""
FE 00 0E 00 01 C0 01 02 32 02
60 24 6B 22 A0 20 69 1E A0 0A 0D 08
01 46 89 30 85 46 B6 58
A2 10 64 0E A0 0C 62 0A
A0 03 02 01 20 A1 03 02 01 00
A7 A8 FF
""")

def crc_x25(data):
    crc = 0xFFFF
    for byte in data:
        crc ^= byte
        for _ in range(8):
            crc = ((crc >> 1) ^ 0x8408) if crc & 1 else crc >> 1
        crc &= 0xFFFF
    return (~crc) & 0xFFFF

def receive_v1(peer):
    raw = bytearray()
    while not raw or raw[-1] != 0xFF:
        part = peer.recv(1)
        if not part: raise ConnectionError("closed before EOF")
        raw += part
    if raw[0] != 0xFE: raise ValueError("unexpected S101 BOF")
    decoded, escaped = bytearray(), False
    for byte in raw[1:-1]:
        if escaped: decoded.append(byte ^ 0x20); escaped = False
        elif byte == 0xFD: escaped = True
        else: decoded.append(byte)
    payload = decoded[:-2]
    received = int.from_bytes(decoded[-2:], "little")
    if crc_x25(payload) != received: raise ValueError("bad CRC")
    return bytes(payload)
```

NOTE The request is 51 bytes and its CRC bytes are A7 A8. Replace the documentation-only address with the device or current Cluster member being read.

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Connect and read one CRC-valid response

```
assert len(REQUEST) == 51
assert crc_x25(REQUEST[1:-3]) == int.from_bytes(REQUEST[-3:-1], "little")

with socket.create_connection((DEVICE, PORT), timeout=3) as peer:
    peer.sendall(REQUEST)
    response = receive_v1(peer)
    print(f"CRC-valid EmberData response: {len(response)} bytes")
```

Production client requirements

REQUIREMENT	GUIDANCE
S101 stream decoder	Handle TCP fragmentation, multiple frames, escaping/CRC and Variant 2.
EmberData fragments	Reassemble First/Middle/Last packets before decoding the logical Glow body.
BER / Glow	Use the official SDK or a maintained compatible library; do not parse values by byte offsets.
Discovery	Browse live nodes and fields; tolerate additive parameters and absent licence-dependent branches.
Writes	Set one clear value, then wait for authoritative QualifiedParameter confirmation.
Keepalive	Send S101 keepalive requests during idle periods and reconnect with backoff.
Reconnect	Rebrowse and restore all directory interest/subscriptions.

Validated keepalive

MESSAGE	S101 VARIANT-1 WIRE HEX
Request	FE 00 0E 01 01 94 E4 FF
Response	FE 00 0E 02 01 FD DC CE FF

NOTE For production browsing and writes, prefer the official Ember+ Viewer or client libraries rather than embedding captured BER messages.

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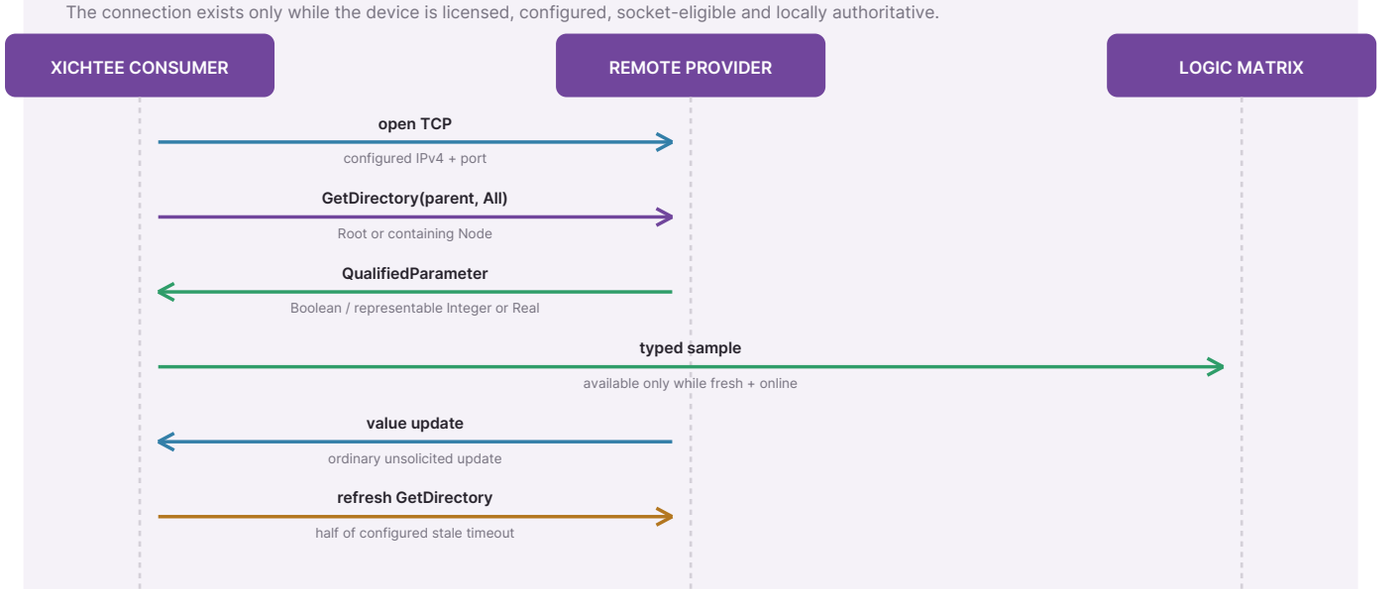
11 · XICHTEE lazy consumer

One remote Parameter becomes one Logic source

The lazy consumer opens one plain TCP/S101 connection to the configured provider and requests Root for a one-component path, or the selected Parameter's containing Node for a deeper path, with field mask All (-1). It accepts only the exact configured Parameter and the containing-directory access establishes update interest. It does not recursively load the provider tree, resolve templates, subscribe with a numeric StreamIdentifier or write the remote value.

LAZY MONITORING CYCLE

The connection exists only while the device is licensed, configured, socket-eligible and locally authoritative.



A missing refresh, offline scope, unsupported value or connection failure makes the Logic source unavailable.

REMOTE PARAMETER	CONSUMER BEHAVIOUR
Boolean	Available as a Boolean Logic sample.
Integer	Available from -2,147,483 through 2,147,483; converted to signed x1000 Logic form.
Real	Available from -2,147,483.648 through 2,147,483.647; finite values are rounded to x1000 resolution.
UTF8String / other	Unsupported for the Remote Ember+ Logic source; the value is unavailable.
StreamIdentifier	Streaming Parameters are not supported in this release; use an ordinary scalar Parameter.
Online state	An explicit offline target or parent makes the sample unavailable. A received Value marks the Parameter and parents online unless that same update explicitly says offline.

NOTE Remote Ember+ is an input only. The XICHTEE device never sends SetValue to the monitored provider.

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Freshness, keepalive and recovery

EVENT	OBSERVABLE RESULT
Fresh value	State becomes monitoring; Logic can use the typed value.
Half stale timeout	The consumer requests the selected Parameter's containing directory again even if no change notification arrived.
Full stale timeout	The value becomes unavailable; the connection is closed and retried.
Idle transport	An S101 keepalive is sent after about 10 seconds; a missing response closes the connection.
Failure	The status reports a state/error and retries after about 3 seconds.
Reconnect	The target containing-directory request is sent again; no previous value remains authoritative.

Use in Logic Matrix

Choose Remote Ember+ monitored parameter as a Logic input. Boolean comparisons use TRUE/FALSE; Integer and Real samples also support the numeric comparison choices and thresholds. Treat Unavailable as a fault condition during commissioning. A maintained Rule driven by an unavailable Logic result must not become active.

IMPORTANT The configured path is device-local. Cluster Followers do not run this input-only consumer, and a Backup runs it only while that Backup is the ready elected leader.

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12 · Cluster and persistence

Read access and write authority are separate

CLUSTER EMBER+ BEHAVIOUR

Every SetValue still passes the central Cluster ownership decision.

STANDALONE / OFF

Browse, subscribe and write according to parameter access.

PRIMARY MASTER

Browse, subscribe and write on the active master.

FOLLOWER

Browse/read/subscribe remain available; all SetValue operations are ignored.

BACKUP STANDBY

Browse/read/subscribe remain available; SetValue is ignored.

BACKUP LEADER

Writes are accepted only while the ready elected backup owns control.

AUTHORITY CHANGE

Backup Ember connections close on promotion and return to standby; reconnect.

Followers and standby Backup members can still publish followed Rule Active notifications.

STATE CLASS	PERSISTENCE / CONFIRMATION
Rule Active	Saved automatically; startup restores the last verified save.
Custom preview/play/pause	Runtime controls; momentary Play/Pause return false.
Configuration SetValue	RAM changes save after about 120 seconds of quiet time.
Qualified echo	Confirms the current authoritative value, not that this change has been saved.
Ignored Cluster write	Best-effort authoritative value publication corrects optimistic state.
Power cycle	Do not power-cycle immediately after a configuration write awaiting autosave.

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Rule Active retention

Active retention includes accepted manual, protocol, input and Cluster changes. After an idle period, an unchanged state is normally saved after about 30 seconds. Further background Active saves are spaced at least 120 seconds apart; continuing changes become eligible after about 120 seconds of unsaved changes. Busy traffic, saving, updates or recovery can delay this, and configuration saves can capture Active sooner. This is separate from the configuration SetValue delay above.

A controlled restart saves and verifies the Active state captured for that restart. Stop sending changes once requested; later changes are outside that snapshot, and saving can keep the restart pending. Sudden power loss or an unexpected reset restores the last verified save. Neither an echo nor a fixed wait proves that an individual Active change has been saved. Reconnect and verify effective Rule state and output against current controller intent.

IMPORTANT Reconnect and rediscover after either Backup authority transition. This intentionally prevents a partial S101 write from crossing the ownership boundary.

Outbound consumer authority

ROLE	LAZY CONSUMER
Standalone / Primary	Runs when licensed, enabled, valid and allocated a socket.
Follower	Suppressed; the device does not use input-only remote monitoring to mutate followed state.
Backup standby	Stopped and unavailable.
Backup leader	Runs only while the ready elected Backup owns local control.
Authority loss	Closes the outbound connection and invalidates the sample before Logic evaluates again.

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13 · Operations and reference

Troubleshooting

SYMPTOM	CHECK
Provider TCP refused	Licence, port, non-zero Ember sockets, applied restart, socket budget, network path and Cluster transition.
Consumer awaits selection	Save a usable provider endpoint and stale timeout, then use Browse Provider to verify and apply a 1–6 component Parameter path.
Consumer stays disabled	Enable flag, Ember+ licence, provider settings, Cluster role and available socket budget.
Consumer backoff/error	Remote endpoint reachability, ordinary scalar Parameter path, online state, value type and stale timeout.
Connected but no data	The provider sends no greeting; issue GetDirectory.
No update after browse	Browse the actual parameter or an ancestor; root browse alone does not imply all periodic status traffic.
Write appears ignored	Qualified path, value type/range, maintained input ownership and Cluster authority.
Optimistic UI differs	Replace local value with the authoritative QualifiedParameter response.
Connection closes	Reconnect with backoff; rebrowse and restore all interest/subscriptions.
CRC failure	Decode escaping first, then calculate X-25 over payload and compare little-endian CRC.
Large directory incomplete	Reassemble EmberData First/Middle/Last fragments before BER decoding.

Quick reference

TOPIC	VALUE
Roles	XICHTEE Ember+ provider plus one monitoring-only lazy consumer
TCP port	Stored default 9000; zero provider sockets disables the provider
Framing	S101 Variant 1 escaped + CRC, or Variant 2 length-delimited
Glow DTD	2.50
Operations	GetDirectory, Subscribe, Unsubscribe, SetValue
Writable scalar types	Integer, Boolean, UTF8String
Readback	Qualified tree/parameter data; verify authoritative value
Provider idle policy	Connection may close after about 15 minutes without progress
Lazy consumer	One numeric Parameter; Boolean or signed-x1000-representable Integer/Real; no StreamIdentifier
Provider browser	On-demand Node/Parameter browsing, verified path selection and no remote writes

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Official references

Official Ember+ SDK repository
https://github.com/Lawo/ember-plus

Official Ember+ protocol document
https://github.com/Lawo/ember-plus/blob/master/documentation/Ember%2B%20Documentation.pdf

Official Ember+ Viewer releases
https://github.com/Lawo/ember-plus/releases

Compatibility

This guide applies to LMPSH-IP and HRNL-25W firmware v1.3.0 Release (build 310). It documents the public-safe provider tree, one device-local lazy consumer, product-specific access/ranges, notification rules, persistence and Cluster behaviour in addition to Ember+/S101 framing.

IMPORTANT The provider is unauthenticated and unencrypted. Any reachable consumer can attempt writes to exposed read/write parameters; network isolation is part of the integration contract.

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