

The Connect Initiative

White Paper consultation feedback & responses

19th November 2021

On the 22nd of June 2021, GOGLA launched [the Connect White Paper](#) to propose a universal connector and device-to-device firmware guidelines for 12V SHS Kits and appliances. The White Paper requested GOGLA members and industry stakeholders to review the proposal and provide feedback from their organization.

Feedback was received from 11 different companies, including manufacturers, distributors, vertically-integrated companies and one network organization. We've received feedback from companies / orgs based in China, India, Africa, and Europe. The consultation period was open from Jun 22 – Aug 31st, 2021. The White Paper was downloaded more than 200 times in this period.

It is important to note that many companies and partners have been actively involved in the initiative through the Technology Working Group, the Connector Taskforce, and the Connect Steering Group. Many of the leading players did not provide written feedback to the White Paper, though their active participation and interest in the initiative is well noted.

The consultation feedback is listed here in an anonymised format, with responses from GOGLA and the initiative partners shown in green. We will also present and discuss these on a Technology Working Group call. If you have any further questions or comments at any time, you can email d.corbyn@gogla.org

Company A

1. Does the Connect Initiative present a compelling value proposition for your company and the industry? What is the value for your company?

Its target is addressing one of our current core business needs to make more expensive appliances (starting from TV upwards) lockable in order to prevent theft and therefore reduce loan portfolio risks.

Well noted. Indeed, the initiative aims to establish a low-cost and secure method of locking PAYGo appliances .

2. How will your customers, supply chain partners and investors react to Connect?

We didn't yet face customers with lockable appliances. We fear impact on affordability for our customers with introducing cost-up for appliance lockability especially on the entry level TV range.

From TV supplier side, we had for now rather reluctant support to do changes on their PCB (Printed Circuit Board). Supporting OpenPAYGO Link hardware-wise on a TV PCB e.g., tremendously increases the costs of the PCB due to more specialized low-MOQ PCB production. Having an add-on OpenPAYGO Link PCB added onto the TV PCB eases things up in convincing suppliers and reduces costs to the actual costs of the add-on PCB. However, methods of locking the appliance then become

quite limited and tampering is easier to perform (e.g., customers re-connect power wires from the add-on PCB directly to the appliance main PCB).

This is indeed a tradeoff, especially for TVs where you have less control over the PCB. An add-on PCB should be cheaper in those cases but does present a risk of tampering. One potential solution would be to integrate it with a lower-cost PCB within the TV, for example integrate the locking mechanism within the much cheaper Infra-Red reception PCB. This then makes tampering harder as you need the remote to use the TV and you can control the signal sent from the remote PCB to the main PCB.

Alternatively, some main PCBs of some TVs might have UART or other form of digital control of usage that might be controllable from a simple add-on PCB and much harder to tamper with.

3. What do you feel are the main challenges/ risks of an industry transition to the Connect initiative? Can these be overcome, and how?

With the current OpenPAYGO Link approach:

- Increase in costs on entry level TV systems (very price-sensitive market). This includes:

- high costs for the proposed 3-pin connectors

This is true, however group orders on this component are likely to reduce the cost as it becomes more common / produced in volume.

- cost-up for 3-wire power cables

The third wire can be of very low quality, it might not be very significant.

- additional hardware-components on SHS controller

Indeed, this will introduce an additional cost though expected to be marginal if economies of scale and tech maturity can be achieved.

- Add-on PCB costs on appliance side.

This is discussed in the answer to question 2.

- Too high costs for even lower-cost appliances such as fan

Indeed, the cost might be higher for lower cost appliances and in that case, it may not make sense at all to integrate the appliance. That is why the locking mechanism should be voluntary and not compulsory, to keep it only for appliances that are worth protecting (higher value appliances). It probably doesn't make sense to have it on a fan based on current costs.

We should work towards a full cost estimate for this to enable manufacturers to do a cost-benefit analysis.

4. Would you like to adopt the Connect Technical Guidelines?

Due to the given cost-up reasons, currently not for our entry level TV SHS.

For our next generation or larger SHS powering more expensive appliances (such as fridge), Open PAYGO Link may be an option. This however leads for us to the down-side that it would be an

additional appliance unlocking technology within the same product on top of our proprietary low-cost solution for TV (in order to stay compatible towards the entry level TV systems). This introduces extra costs.

We would be very interested in knowing how you achieve lower cost locking for TVs, it could be a source of inspiration to help reduce the cost.

The extra costs here might be compensated by the availability of cheaper versions of the larger TVs as several distributors would be ordering the exact same model (OpenPAYGO Link compatible).

5. How can we work together to make this a reality?

Happy to have further discussions on our experience on cost-sensitivity of the currently proposed solution for appliances with low margin.

Also, we would appreciate exchange of experience in convincing appliance manufacturers to integrate Open PAYGO Link / Nexus Channel as a lockability solution into their products (either inbuilt or options for add-on PCB).

Well noted. Indeed, coordinated outreach to appliance manufacturers to raise awareness about the hardware / firmware is a good idea.

Company B

We had a chat internally around the business to gather some feedback on this – as you might be aware <<company name>> plays in many spaces in the value chain – hardware, software and distribution. We divide them up into different divisions so I've sought feedback from around the business on this.

The main concern for the Connect Whitepaper comes from our **Distribution businesses**, who are worried that the money they spend acquiring a customer and getting them onto our platform could be lost if a customer moves to another product from another provider. Often in our business model, it is the subsequent upgrades to new products where the profit is made for our distribution businesses. So they are worried about losing this.

Let me know what your thoughts are on this and if you have already thought about addressing this?

From a hardware perspective we don't see a major issue, but would be good to address the distribution businesses concerns.

The risk of lost business is a significant question; it was identified and discussed in the White Paper (pages 17, 21-22). In summary:

The increased competition [enabled by the Connect strategy] could break companies' long-term relationship with their customers, leading to lost revenue from the upgrades and add-ons, which may threaten the company's profitability and long-term financial sustainability. This is particularly concerning given that the profitability from an individual customer is often secured from the long-term relationship and follow-on sales.

Competition will come from both brand rivals and the grey market. The 'Basic' connector in the Family (the 5.5/2.X mm barrel) has been selected based on its commonality in grey market products (and QV products). However, this is a double-edged sword, facilitating consumer flexibility and

choice, as well as easier integrations with the wider market, but also opening the door to low-quality and low-cost products that fail to meet minimum quality standards. Note, if you already have a 55/25 or 55/21 output port for appliances (which many models do), you are open to this risk irrespective of you're strategy / alignment with Connect.

On the other hand, even if a universal connector is present, we expect there will still be a lot of 'stickiness' with customers. From the customer side - If they're happy with a good product and service, and you've managed to build up trust. On the company side – you know your customer (contact details, location, etc) and their credit risk profile (payment history).

As well as losing customers to competitors, there's also the chance to gain customers. There will be winners and losers. One can imagine companies that are competitive on price (total cost of ownership and PAYGo payment amount), have wide distribution / good sales, and good brand / service reputation will do well. Whilst we believe that 'competition is good', we recognise that this can be problematic where there is no level playing field (i.e. 'unfair' competition from non-quality-verified products) – this is likely to be the cash sale market though, and it is expected many customers will still prefer PAYGo as it's more affordable and reliable.

Other potential positive outcomes are highlighted in the White Paper:

Figure 8 - Expected outcomes for consumers & companies



Source: Connect White Paper, page 16.

Clearly this is a difficult decision, with commercial and strategic considerations (beyond technological ones). Manufacturers will have to weigh the risks and opportunities for their brand.

Company C

<<Company>> very much hopes to achieve the unification of the industry and guide the industry to jointly abide by this rule. I also hope to work out this rule with GOGLA;

We are interested in the universal connectivity of the product and the universal Pay as You Go product;

The versatility of the product hardware can be achieved by changing the components, because all designs are done by ourselves. This is a fairly simple matter for us. If GOGLA unifies this standard in the future, <<Company>> will follow Unified requirements for product updates and port improvements. But I hope not to use special component requirements; the price is not too high.

The software platform can be unified with a few people is what we want to see, because we are also facing the different needs of customers, when Angaza, Paygee, Solaris can be unified, for our products. Promotion is very helpful.

Thanks, and well noted.

Organisation D – a network organisation

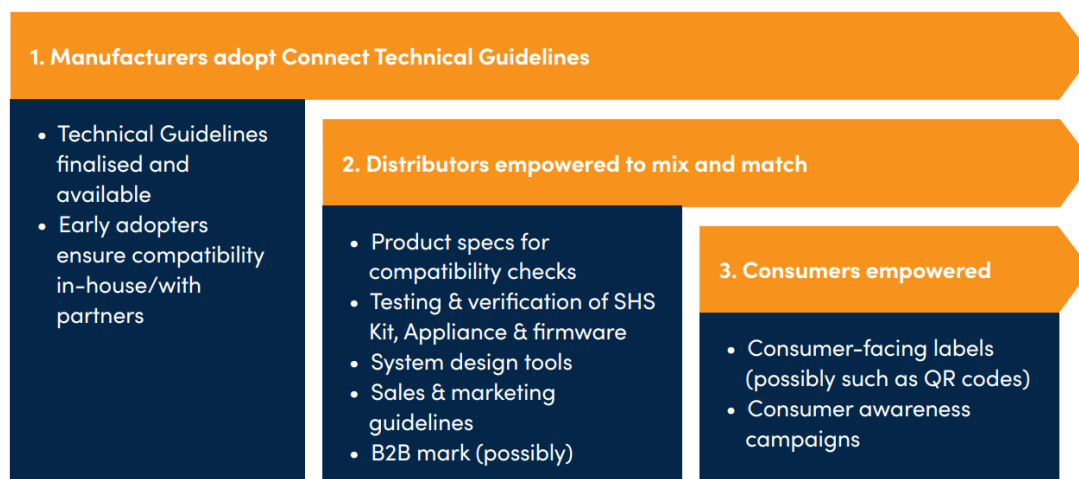
<<Company>> took some time to think about the best ways the <<company>> and <<company's>> members can support this initiative. Compliments for what you've learned so far about the opportunities and challenges for hardware interoperability. We definitely welcome more dignity of choice for last-mile consumers! Here's what we can do to support this:

Good job on presenting the potential business and impact benefits for distributors resp. their consumers. As the publication rightfully mentioned, however, more consumer research is essential. ...small-scale trials to help answer questions about the new customer journey (incl. how many consumers decide to mix and match appliances, and what support do they need for decision-making?). But equally important, the trials could help to deepen our understanding of the role that distributors should play and how to make this as easy as possible for them. Distributors often face problems with product supply and product info. Therefore many choose to work with just a few brands/suppliers. If not well organised, the interoperability concept might add to that complexity. Most importantly, it would be good to collect evidence on how distributors' additional investments for customer education and after-sales support for interoperable systems compare to new business gains (assuming margins are smaller when selling single appliances as compared to full SHS kits).

Good points. Indeed, more research and practical experience is needed to understand how distributors could take advantage of the opportunities whilst managing the increased complexity.

Note the 'phased roll-out' of the Connect initiative, with distributors being empowered to mix and match coming later as the tech matures and is adopted by more manufacturers. This gives us some time to improve the understanding on this important point.

Figure 11 – A phased approach: moving 'system integration' down the supply chain



Source: Connect White Paper, page 23.

The White Paper also stated the need for more consumer research. This should be on our agenda as we make plans and fundraise for the next stage of the initiative.

Company E

1. Interoperability can enable a quick replacement as distributors can find a similar component quickly, in theory. From another side of the coin, distributors are empowered to select suppliers on components level, this can bring a competition which suppliers may not want.

Well noted.

2. OGS market is very much driven by finance, from supplier finance or third-party inventory finance, both of them are not inclined of multiple suppliers, so to some extent, distributors have to follow.

This point on financiers' motivation is interesting. Following the Connect / interoperability strategy does not necessarily entail working with multiple suppliers. A distributor could still deal with a single supplier (with a product that is interoperable); this would give them flexibility and choice for local partnerships (e.g. matching an SHS kit from a manufacturer in China, with a TV from a local supplier, or vice versa), or for future changes of brands (e.g. to introduce a new TV supplier without having transition issues).

We haven't heard back from any debt providers (inventory finance) or manufacturers / importers with respect to supplier finance.

3. <<Company>> would like to adopt the guideline.

Well noted.

Company F

Our <<Company>> executives and the R&D team all reached to an agreement that involving in this GOGLA project was a very wise decision.

For it will not only push the solar industry's standardization and unification quicker, but also allow the end users to have more bold and facilitate choices when replacing several different solar products. All of these will indirectly improve the quality of life of BOP people in Africa.

That's the perfect manifestations of our company's values and visions!

Well noted, thanks.

Company G

... good to see this very relevant standardization initiative (one can hardly imagine what would have happened if standardization in the on-grid lighting market hadn't happened ...). We're supportive.

Well noted, thanks.

Company H

<<Company>> is very keen. That's one of the reasons that <<Company>> is part of this. Both IEC and IEEE are looking to set-up connector standards and <<Company>> is part of both. Would like to

see if we can take the outcome of this and take it to the IEC and IEEE standards as well. We will need to take it to the Lighting Global standard as well.

Indeed it is critical that the Connect Technical Guidelines and IEC 62257-9-5/-9-8 and VeraSol certification are aligned and complementary. We are working with the IEC TC82 JWG1 and VeraSol on this.

Company I

I do like the idea of common connectors – it has been frustrating to travel in the AC world with the different plugs around the world—if it can happen that you achieve common plugs in the DC plug and play world that is a huge benefit.

This is indeed the common experience and frustration for many people in the developed world. Even though international travel and consumer electronic ownership is obviously less prevalent among ‘off-grid consumers’, I think the principle of being able to power devices from different systems and locations is relevant. In particular, universal connectors and firmware enable the second-hand and thrift markets (e.g. gifting products or parts to family, or increasing the chance of spare parts being available for repair).

Company J

We are proceeding towards adopting the interoperability system for our PayGo tech platform.

Our tech teams have a few questions after studying the Open PayGo suite developed by PayGops and the Nexus Channel core developed by Angaza.

Please let me know if we can schedule a call to discuss our questions with you.

We have spoken with this company and shared more information. It is recognised that there is a low level of understanding about the firmware elements of Connect in the industry, and that we need to build in support and capacity building for SHS Kit and appliance manufacturers.

Solaris and Angaza – as members of the Connect Steering Group – are developing plans for a Connect firmware toolkit, with the code, software verification, tutorial.

Company K

Thank you for the Connectivity whitepaper.

However, without an understanding of what the Open Paygo link and the Nexus channels are, we cannot meaningfully provide feedback.

Please send us the specifications for these products. And can I suggest these are made equally available as the whitepaper?

Solaris and Angaza – as members of the Connect Steering Group – are developing plans for a Connect firmware toolkit, with the code, software verification, tutorial.

These material are available at the moment:

- Detailed information and link to the Technical Specification: [Efficiency for Access Research and Development Fund: Solaris Off-grid](#)
- Detailed information and link to the Technical Specification: [Nexus Channel Core | Angaza Nexus Channel Core](#)

- PaygOps, Paygee and Angaza are becoming interoperable! (solarisoffgrid.com).
- Angaza presents the functionality and benefits of Nexus Channel on this [webinar](#)

Also can we set up a call with you and our PAYG provider to help us understand what you are proposing in terms of universal PAYG connectivity and walk us through how in practice this will work?

We have spoken with this company.

You suggest that the consumer will be able to choose which PAYG provider they want to work with. How then does the money received by that PAYG provider make its way back to the manufacturer or distributor of that equipment - or

- how does everyone get paid
- Who is responsible for breakdowns maintenance and providing technical support for problems? the PAYG provider; the distributor of the SHS ; the distributor of the appliances; GOGLA?

The relationship between the company and customer is not expected to change dramatically. The most common model will remain that a single company provides the SHS Kit and Appliance on PAYGo. A universal connector and device-to-device firmware will however give the customer increased choice to source upgrades/follow-on products from a different provider if they wish (once they have paid off the original provider).

Indeed, one can imagine a scenario where a customer has multiple contracts with different providers (e.g. one for the SHS Kit, one for a TV, one for a mobile phone) – clearly this would be risky and confusing. It would be up to distributors ('PAYGo companies') to identify and manage this risk.

In principle we support advisory, but not mandatory, recommendations for 12V SHS Kit and Appliance interoperability. We make some comments and suggestions as follows:

1. We are disappointed that the committee has restricted itself to 12V SHS. This should apply to all devices supported by Verisol testing, including 3.7V; 5V; 7.4v 12V solar lanterns and SHS and 12V; 24V; 48V and mains inverter Productive Power systems.

Other voltages may be considered in future. 12V is an initial step based on the de facto voltage in the industry today.

2. We note Verisol testing currently covers up to 300W systems, yet connector suggestions are limited to 96W (8A). This is insufficient power. See below [17-19].

The VeraSol 350W is the input limit from the PV module. 100W has been defined as the output as this covers the common appliances used on 12V systems. Productive use tech often has a higher power, though comes at higher voltage and with a distinct system architecture that takes it out of scope of the initial Connect program.

3. The paper only addresses HALF the issues, being the downstream connectivity to appliances and omits reference to the upstream connectivity to PV panels and other energy inputs (mains charging posts; wind; etc). Data interoperability with PV panels is desired so that PAYG switch of capability can (and is being) added to panels to deter theft and provide PAYG functionality where batteries are not part of the system.

Early consultations with SHS Kit and PV module manufacturers determined we should limit the Tech Guidelines to the output port. While there is an opportunity to standardise the PV module size,

voltage and connector type, we heard that the diversity and changeability of these at present make it unsuitable for standardisation at this time.

4. It is essential that input connectors are physically distinct from output connectors, so that one cannot be plugged into the wrong outlet.

Yes, we agree this is very important. Whilst the Connect Technical Guidelines are voluntary, and not relating to PV input ports, we will make the recommendation to SHS Kit and PV module manufacturers that they cease to use this same connector (plug and socket) for the PV module input.

There will inevitably be some legacy products on the market that have the same connector.

5. Similarly output sockets at different nominal voltages 5v; 12v; 24V; 240V must be distinct and unable to be inadvertently connected to the wrong sockets.

Yes, we agree this is very important. The Connect Tech Guidelines stipulate 5v (USB-A) and 12v that are distinct from other universal connector voltage standards.

6. Separate pins are NOT required for data inter connection for DC plugs. DC has a special benefit in that data signals (AC) can easily be filtered from the DC power aspect. Similarly the data signals are of insufficient amplitude such that there is never any danger of a reversal of polarity or significant drop or variability in the DC power voltage.

The Connector and Electrical Taskforce working under the Technology Working Group favoured a separate cable for data due to the higher cost and complexity of sending data over power cables.

7. Twisted pairs can carry up to 10Gbyte data, well above the data speed needed for interoperability or data monitoring. No special interconnectivity or data pins are required.

Same response as for 6.

8. There are already standards in place for telecoms DC power systems and probably in the UPS industry (either norms or standards). The committee should consult with and ensure compatibility with these industries standards and norms. It appears this paper is being written in the absence of any suggestion that we work in a much larger ecosystem, especially as we increase the power capability of our systems.

The Connect firmware guidelines are aligned with the Open Connectivity Foundation protocols for low-bandwidth data.

Standards

9. I would recommend that the committee makes up standards for the power output connectors and creates a logo suggesting these are GOGLA or Verisol compliant. Any manufacturer choosing to use this mark (or similar advertising words) must:
 - a. Ensure the output voltages do not fall outside the specified nominal voltage range
 - b. That the socket can provide the power (current) up to the maximum rated for the output socket, without dropping outside of the specified voltage range
 - c. That ripple (or voltage fluctuations arising from using the port as a data channel) are less than 5% peak to peak of the nominal outlet port).
 - d. That all appliances with a GOGLA compatible plug can safely operate across the entire voltage specification for that connector.
 - e. Have their appliances or products tested by certified verisol testers, that their products comply with these standards. This should be mandatory for SHS testing, and optional is appliances are to be branded as Verisol compatible.

Yes, good point. There will be a *Connector and Electrical Technical Guidelines* that defines the compliance parameters, including for the characteristics you mentioned. This is in development and will be shared with the Technology Working Group in late 2021 / early 2022.

VeraSol are part of the Connect Steering Group and have expressed interest to offer a testing and verification service through their lab network.

A B2B mark to indicate that a product has been tested and is compliant with the Connect Technical Guidelines is certainly an option.

10. The voltage standards (limits) should cover the safe and expected voltage range of all battery types operating at the nominal voltage. Thus Pb-acid batteries float charge up to about 16V (equalisation charge) and down to about 10.5V (the cut-off before sulphation). The limits may need to be extended to cope with other battery chemistries.

The permissible battery voltage range will be defined in the *Connector and Electrical Technical Guidelines*.

11. USB sockets already have standards in place. Any solar system or appliance using these should adhere to the USB standards and be tested against these standards. Note USB sockets have two current levels in place depending on whether the centre (data) pins are open or short-circuit. Appliances should not exceed these current draw levels and should perform a handshake and restrict current draws accordingly.

Indeed, the Technical Guidelines will align and adopt with USB-A for the 5v port (as per current IEC / VeraSol standards).

Proposed Connectors

12. We support the use of USB standards for nominal 5V power connectors (4.5-5.5V 0.5A and 1.5A (with special provision for 2.0A). These are not necessarily limited to mobile phones, many SHS companies use 5V as their primary power output for lights; and even TV's. With the USB-C standard this may well become more common. USB standards already include data provision.

The Connect Family of Connectors includes USB-A for 5v (mobile phones and other loads).

13. We do NOT think we should limit ourselves to USB-A sockets as these are old technologies and the USB standards committees are adopting new standards. Why not simply adopt all the USB technologies, provided manufacturer advertise they are fully compliant with and tested against the relevant USB standards for power (and data).

The Connect White Paper comments on the suitability of USB-C. We concluded it is not suitable as a universal connector for the off-grid market due to the complexity, durability, and cost.

14. Whilst the USB-A is a common and simple standard for output power, it is a much too large connector for power into appliances, which almost universally now use a micro USB or USB-C connector. Thus if the interoperability is to cover appliances as well as power systems, we HAVE to allow for micro-USB and USB-C connectors on these products. Most likely, but not universally, these will be or are already supplied with a cable connecting a USB-A plug to the micro USB or USB C plug. We should NOT restrict the ability of appliances to use the improved connectivity of say the USB-C product. Yes it adds cost, but the additional capability may outweigh the costs. That is our choice.

Response same as for question 13.

15. For 12V output we need a family of connectors.

Agreed, we have proposed a Family of Connectors (see White Paper and Technical Guidelines).

16. We favour the ubiquitous 5.5mm x 2.1mm Jack sockets for 12 V output up to 3A (many plugs are only rated to 3A (not 3.5A)). Such sockets MUST have current limiters or fuses restricting the max current to 3A. The standard should include maximum rush current acceptable over what durations. The 2.1mm pin is much more prevalent with only <<Company X>> (as far as I am aware) favouring the 2.5mm pin. Save the 2.5mm pin for 7.4V. 5.5mm x 2.1mm plugs and sockets are less expensive than the 5.5/2.5mm versions as the 2.1mm pin is favoured by the much larger video/ intruder alarm / monitoring cameras and many more interconnectors are available with corners, tee pieces, male2male; femal2female connectors in every possible shape, size and colour configuration.

The choice of 5.5/2.5 or 5.5/2.1 is going to be tricky. It seems the industry is divided on the choice, and we are struggling to get solid market data. The *Connector and Electrical Technical Guidelines* will get into these details.

17. The 3-pole barrel connector proposed is insufficient. It is only capable of carrying 8A = 96W at 12 V nominal, and yet Verisol standards apply up to 300W. We need to define 10A; 20A and 25A 12V DC connectors. Furthermore, there are no comparable standards set as per USB-A. These 3-pin barrel connectors are used in computers/laptops with a variety of input DC voltage – again no standardisation.

The appliance power limit of Connect is 100W (see point above on the 350W misunderstanding).

18. We propose that [xxx] connectors (essentially smaller versions of Anderson connectors) be standardised for the 12V high current output (up to 20A). These will have familiarity to those accustomed to Anderson connectors (used throughout the DC UPS industry). The standard should include maximum rush current acceptable over what durations.

Given the 8A limit, the Anderson connector is over-spec'd. This may be a good option for future high-power connectors if we choose to go down that route.

The *Connector and Electrical Technical Guidelines* does include parameters on in-rush current. This will be shared for inputs in the coming months.

19. We propose the Anderson colour coded and keyway protected cable connectors be used for 24;36;48V systems with current capacities of 50; 120 and 175 A depending on the physical size chosen. These have excellent high standards and voltage incompatibility protection physically built in with colour coding to help users. The standard should include maximum rush current acceptable over what durations.

As per 18.

20. We do NOT require more than two pins for DC appliances. Data can be superimposed on the DC power channel and trivially extracted at either end. Why add cost and complexity to a simple system?

The *Connector and Electrical Taskforce* working under the *Technology Working Group* favoured a separate cable for data due to the higher cost and complexity of sending data over power cables.

21. You NEED to set standards for mains out power from these systems in the Verisol testing standards and for connectors. (Providing data transfer over these cables is an interesting, but not insuperable challenge.) Such voltages (and DC voltages over 60V) can Kill so standards are essential, including residual current circuit breakers and adequate grounding (earthing) of the SHS's. I would propose you adopt as a minimum UK; Euro and US mains voltages and standards and that these (mains) plugs and sockets are NEVER used for DC output or input power.

The Connect initiative is limited to 12V systems.